Since the spruce LTAs (LTA1 and LTA 13) represent the vast majority of the late-successional forests (580,191 acres), the probability of catastrophic disturbance increases every decade. From a social perspective, these disturbances may be unacceptable. However, plants and animals evolved under large-scale disturbances The danger to species and ecosystem function may lie in *not* allowing some degree of large-scale disturbance to occur in the future.

There is insufficient information on the range of natural variability for the older-forest component of LTAs. At least in the spruce LTAs, the Forest is probably seeing a landscape approaching the peak of late-successional forest

Introduced and Extirpated Species

Introduced Species

Many wildlife and fish species on the Forest have been introduced Most were introduced because they were beneficial to the early settlers This category includes cattle, domestic sheep, horses, and dogs. Other species were introduced to enhance recreation Examples include rainbow trout, brown trout, brook trout, kokanee salmon, and moose Many introduced plants arrived because of settlement activities in the 1800s Early settlers brought livestock, wagons, and railroads that helped transport and disperse introduced plants. Examples are Kentucky bluegrass, dandelion, Canada thistle, red clover, Russian thistle, and cheatgrass.

The ecological implications of many of these introductions are largely unknown A few, however, have some known ecological impacts. According to the Range of Natural Variability (RNV) report, early grazing by domestic livestock quite possibly lead to a change in the plant-species composition and a degradation of riparian areas The RNV report also discusses the negative impacts that introduced fish species have on the native fishes of the Forest

Extirpated Species

The species known to have disappeared from the Forest include the bison and wolf It is quite possible that the grizzly, lynx, and wolverine have also disappeared (see the RNV report) Our knowledge is limited about the fate of smaller, less noticeable animals So it is possible that more species than these have disappeared

There are no records of plant species extirpated from within the Forest. The earliest known botanical inventories in the area were compiled during the Hayden Expedition (Porter and Coulter, 1874) and the Wheeler Expedition (USGS, 1878) These inventories were more extensive than intensive and did not concentrate on the lands within the RGNF There is no definitive record, of whether any plant species have been extirpated from the RGNF.

As with introduced species, the ecological implications of the species extirpated are unknown What can be said is that all the species occupied the upper-trophic level in the food chain What is not known is if the lower-level carnivores (e g., bobcats, coyotes, foxes) have filled the trophic-level "vacancy" created by the extirpations

Noxious Weeds

ABSTRACT

Disturbance of a site often causes that area to be invaded by noxious weeds Activities that contribute to noxious-weed invasion are road maintenance and construction, timber harvest, range and livestock improvements, the construction of recreation facilities, recreational-livestock use, and recreational pursuits Some noxious-weed species found on the RGNF are leafy spurge (*Euphorbia esula*), napweed (*Centaurce* spp), yellow toadflax (*Linaria vulgaris*), and Canada thistle (*Cirsium arvense*) The Forest treats about 180 acres of noxious weeds per year

The noxious-weed program will emphasize the control of noxious-weed populations, not necessarily the eradication of the plant Residual infestations will exist within the Forest and serve as a seed source for new infestations This should not be expected to change in the future

INTRODUCTION

A "noxious weed" is a non-native plant that aggressively invades native ecosystems, or is detrimental to their environmentally sound management Noxious weeds crowd out native plants and animals and reduce productivity

The State of Colorado designates noxious weeds, in addition, counties list plants that are of local concern Besides those listed by states and counties, other plant classes are considered weed pests These include species native to the local area but poisonous to livestock, and native plants undesirable on specific sites.

Section 10 of the *Federal Noxious Weed Act of 1974* lists noxious weeds of national concern. Some noxious-weed species found on the RGNF are leafy spurge (*Euphorbia esula*), napweed (*Centaurce* spp.), yellow toadflax (*Linaria vulgaris*), and Canada thistle (*Cirsium arvense*)

The entire Forest is susceptible to the invasion and growth of noxious weeds Some activities that may create habitat for them are timber harvest, road maintenance and construction, trail maintenance and construction, grazing and range-improvement construction, construction of recreational facilities, recreational-livestock use, and recreational-equipment use

The portions of the Forest that have been disturbed the most are the areas that have been logged These areas are within the mixed-conifer, aspen, and spruce-fir Land Type Associations A survey of the road systems within these areas on the Divide Ranger District of the Forest showed a patch of Canadian thistle for every seven-tenths of a mile of road

AFFECTED ENVIRONMENT

Noxious weeds invade disturbed areas where mineral soil is exposed, such as landings, temporary roads, skid trails, and loading ramps These are all sites where a low seral stage is evident and primary succession is beginning As noted above, Forest construction activities, livestock grazing, and recreation use and occupation can also contribute to noxious-weed invasion

The Forest treats about 182 acres of noxious weeds per year Not all weed infestations are treated each year due to budget limitations

RESOURCE PROTECTION MEASURES

RGNF weed management is environmentally sound and economically feasible It encourages the use of various approaches to control noxious-weed infestations chemical, mechanical, biological, and quarantine methods are some options used Management is coordinated with the state of Colorado, counties, and cities The coordinated effort is directed toward a prevention-and-control program and common inventory, mapping, monitoring, and reporting procedures

Specific prevention methods include using certified weed-free seed and feeds, and reseeding disturbed areas

Noxious-weed sites will be monitored to plan treatment strategies, which include the use of biological and chemical agents Chemical treatment of infestations is done selectively, on an individual-plant or group-of-plants basis The use of chemicals around water is restricted to chemicals designed for such use Application must be done by persons trained in their use and handling requirements Forest personnel are to follow label directions for application and handling of chemicals

We expect that biological control will be used more in the future, with the trend toward control rather than elimination or eradication of existing weeds

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Noxious weeds become established through a combination of two situations A seed source is available and a seedbed has been prepared Weed seed enters the Forest by motor vehicles, on timber-harvesting equipment, by livestock, or in seed mixes used for

revegetation Other seed enters the Forest from private lands through normal seed-dispersal methods, i e., birds, wildlife, wind, and water.

Whenever there are soil disturbance and the proper seedbed, weeds will become established Logging, grazing, road and trail construction, road obliteration and maintenance, recreation construction, and range-improvement construction are some soil-disturbing activities that occur on the Forest Weed-infested acreage is expected to increase under all Alternatives Alternatives A and F would not have as much acreage affected, however, because timber harvest is limited in these Alternatives, thus fewer acres would be affected

Complete eradication of weeds is not expected to occur Residual infestations will exist within the Forest and serve as a seed source for new infestations This should not be expected to change in the future

AIR RESOURCES

ABSTRACT

Air quality on the Rio Grande National Forest (RGNF) rates among the best in the country No violations of ambient Air Quality Standards have occurred on the Forest, nor have any activities on the Forest caused violations of these elsewhere

The La Garita and Weminuche Wildernesses are Class I areas, as defined by the *Clean Air Act* (see "Legal Framework" below). The rest of the Forest, including the South San Juan and Sangre de Cristo Wildernesses, is Class II

INTRODUCTION

Legal Framework

The *Clean Air Act* and its amendments give states most of the authority and responsibility for managing air quality The Act mandates different levels of protection for Class I, Class II, and Class III lands, by specifying the amount of pollution allowed in them. (Class I areas are Wildernesses in existence as of 8/7/77 and exceeding 5,000 acres, including later expansions All other National Forests and National Grasslands in the Rocky Mountain Region are Class II, including new Wildernesses No Class III areas have yet been designated)

Class I areas are pristine, like Wilderness, and are allowed very little pollution The Act enables the Forest Service to protect "air-quality-related values" (AQRV's any Wilderness components that can be modified by human-caused air pollution, such as soil, water, flora, fauna, visibility, cultural resources, geology, and odor) in Class I areas Protection occurs by applying the Act's Prevention of Significant Deterioration (PSD) provisions Protection of

Class II Areas is given under the Best Available Control Technology (BACT) provisions of the Act

Also, the *Wilderness Act* gives the Forest Service the responsibility to preserve and protect the unspoiled character of Wilderness-- which can be affected by air pollution

In addition, Environmental Protection Agency regulations require federal agencies to decide if their actions conform to state air quality implementation plans Federal agencies must not cause or contribute to any violations of air quality standards or impede a state's progress in meeting air quality goals The Forest's role is to coordinate with state air quality control efforts, and to protect Wilderness and Class I air quality

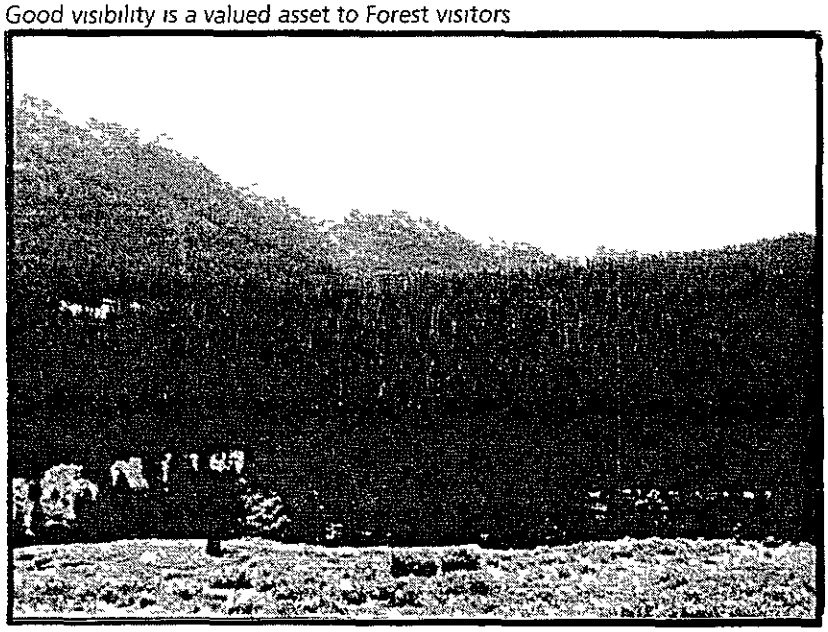
Furthermore, the State of Colorado's regulations are possibly the most effective in the country in terms of opportunities for Wilderness protection Unlike the federal law, state air quality regulations allow the Forest Service to protect values in Class II Wilderness Areas equivalently with protections required for Class I areas

The Forest Service's Rocky Mountain Regional Office, in Golden, Colorado, has begun to develop "Limits of Acceptable Change" (LACs) for each AQRV LACs specify how much human-caused change will be allowed These draft LACs are found in the Regional air quality management guide, titled *Managing Air Resources in the Rocky Mountain Region*

AFFECTED ENVIRONMENT

Air quality in the RGNF is good for all air pollutants The Weminuche Wilderness and much of the RGNF consistently have some of the best visibility in the nation The air pollution that does exist on the Forest comes mostly from unpaved roads, and smoke from prescribed fires and wildfires

Good visibility is a valued asset to Forest visitors



The Forest contains portions of two Class I areas the Weminuche and La Garita Wildernesses The South San Juan and Sangre de Cristo Wilderness Areas are Class II

The aforementioned guide, *Managing Air Resources in the Rocky Mountain Region* lists potential emission sources for the RGNF This document identifies visibility and lake chemistry as having high and moderately high potential, respectively, for impacts

Visibility and lake chemistry monitoring will be used to decide what controls are necessary to protect existing conditions Collection of visibility-monitoring data has occurred along the Continental Divide and in the Great Sand Dunes National Monument Lake chemistry data have been collected on 57 high-elevation lakes in four RGNF Wilderness Areas Thirty-four lakes had chemistries that suggest they are sensitive to changes in acidity Monitoring will occur in some the most sensitive of these, to observe trends

Strict protocols are used when sampling sensitive high-elevation lakes

The entire Forest meets National Ambient Air Quality Standards. The closest area in non-compliance is the town of Pagosa Springs, 20 miles west of the Forest boundary No known Forest activities contribute to the Pagosa Springs air-Quality problems

RESOURCE PROTECTION MEASURES

The Forest Service is responsible for protecting AQRVs in Class I areas from adverse effects caused by air pollution. This responsibility is carried out through involvement in the Clean Air Act's PSD (Prevention of Significant Deterioration) permit process These permits are issued by the state or EPA, but the Forest Service has a Clean Air Act mandated role in providing comment to the regulatory agencies regarding potential air pollution impacts of large new pollution sources. The Forest Service's responsibility includes (1) identification of "sensitive receptors," if any, for each of the various AQRVs, (2) deciding the potential effect, if any, that a proposed new source of air pollution will have on these sensitive receptors, and (3) deciding if a potential effect is adverse

Smoke from prescribed burns is managed according to a Cooperative Agreement ("The Colorado Smoke Management Memorandum of Understanding") between the State and the USFS (adopted January 1, 1995) In addition, permits are required for each individual planned burn. Modeling runs required for the permit evaluate potential for particulate matter emissions for each burn

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

None of the Alternatives considered will substantially change existing air quality on the Forest Use of motorized vehicles, particularly on unpaved surfaces, does produce vehicle

emissions and dust, but this is a temporary and localized effect Because more roads would be closed in Alternative F, there would be slightly less potential for air quality degradation Conversely, because Alternative B projects the most motorized use, it would be most likely to reduce air quality somewhat.

Air quality is temporarily lowered at developed recreation sites, not only by vehicle emissions and dust, but also by smoke from campfires This effect is similar and minor for all Alternatives

If oil, gas, and mineral exploration and development occur, they would affect air quality Alternatives A and F project one exploration well, the other Alternatives project 23 of them. Effects would be short-term and include engine emissions from drilling activities, possible emissions from flaring gas during well testing, and release of gases during drilling

Oil and gas development is anticipated in Alternatives NA, B, D, E, and G Emissions associated with oil and gas development are primarily VOC (volatile organic compounds), CO (carbon monoxide), and Nox (nitrogen oxides)

Development of oil and gas is not likely in any Alternative, based on the level of activity in the past Without development, air emissions are expected to be nondetectable

Wildfires and prescribed burning both generate smoke and particulates. Except for wildfires, burning will be planned on days when adverse air quality impact on smoke-sensitive areas can be minimized

Smoke dispersion is a key consideration in deciding to do prescribed burning Alternatives A and F should have more opportunities for prescribed natural fires Moreover, wildfires may be larger, due to lack of access, in these two Alternatives Over time, Alternatives A and F may produce more smoke pollution

Wood is a primary heat source for many San Luis Valley (SLV) residents Most of this wood comes from the Forest The use of wood-burning fireplaces and stoves contributes to air pollution, so the availability and price of firewood from the Forest indirectly contribute to air-quality degradation. This effect has not been shown to cause a violation of standards in the SLV

The amount of firewood available, and people's ability to collect and use it, are influenced by many factors, including population growth, slash requirements, scarcity of firewood close to population centers, economic conditions, and possible local-government restrictions on the use of wood-burning devices to reduce air pollution The amount of easily available firewood is expected to change somewhat between Alternatives With fewer timber harvests in Alternatives A, F, and E, there will also probably be less easily available firewood

CUMULATIVE EFFECTS

All areas are currently meeting air quality standards, the cumulative effects from all activities have not significantly degraded air quality to date Nor do we expect them to Planned activities will be controlled through mitigation to prevent their cumulative effects from having unacceptable impacts on air resources

TIMBER RESOURCES

ABSTRACT

Timber resources have provided valuable products both historically and in recent years About 8% of the Forest has been affected by harvesting since records have been kept From 1948 to 1993, timber sale sawtimber volume (live) sold averaged 19 7 million board feet (MMBF) per year From fiscal year 1982 through 1991, RGNF commercial sawtimber sale levels averaged 28 MMBF per year Sale levels have declined since that time—5 4 MMBF was sold in 1994 Demand for small sales and other forest products, however, appears to be increasing

About 38% of the Forest's land base is "tentatively suitable" for timber management Most of the Forest's timberlands are in mature- to late-successional forest structure classes Only Management Areas 4 21 - Scenic Byways or Railroads, 4 3 - Dispersed Recreation, 5 11 - General Forest and Rangelands, 5 13 - Forest Products, and 5 41 - Deer and Elk Winter Range allow timber harvesting as part of the suitable and scheduled timberlands

Assuming first decade averages for experienced budget levels, Alternative B will result in harvesting an average of 36 4 thousand cunits (MCCF)(15 MMBF/yr) of conifer sawtimber over 2,334 acres of suitable timber lands, per year Alternative A will have no planned sawtimber harvest Other Alternatives, from most to least in planned (conifer) sawtimber harvest (average per year) from suitable timber lands are G (28.9 MCCF [11 MMBF] on 1,594 acres), D (25 3 MCCF [9 MMBF] on 1,661 acres), NA (24.0 MCCF [9 MMBF] on 1,594 acres), E (18 9 MCCF [6.5 MMBF] on 1,271 acres), and F (7 6 MCCF [3 MMBF] on 555 acres).

In Alternatives B, G, D, and NA, harvesting will be dominated by the shelterwood harvest method In Alternatives E and F, harvesting will be dominated by group selection

Effects vary between Alternatives for changes in structure class (acres), and levels of reforestation, and thinning Road construction into unroaded areas for the ten-year period of the Plan is expected to be 3 miles for Alternatives B, and 1 mile of road construction into undeveloped areas is expected in Alternative NA

The availability of other forest products is expected to be highest in Alternative B, lowest in Alternative A Only Alternative B reflects a rise in full-budget Allowable Sale Quantity (ASQ) from the current ASQ The cumulative effects of past, current, and planned harvesting (through the ten-year plan) will be less than 10% of the Forest, under any Alternative

INTRODUCTION

Timber resources are those originating from the trees of the Forest The RGNF contains valuable timber resources—valuable as a primary component within forested communities, necessary for sustaining the plants and animals that reside there, and important to the

people who use wood products from, and recreate on, the Forest's timberlands They include pinon pine and juniper trees in the lower elevations, cottonwoods along riparian zones, mixed-conifer and aspen stands at middle elevations, and extensive stands of spruce and fir, which dominate the RGNF

Timber stands shelter and influence a myriad of ecological niches that enable a broad spectrum of flora and fauna to exist and flourish Forests are important in holding soils in place, in capturing precipitation, moderating runoff levels, and positively influencing water quality Trees are a key component of the Forest's high scenic quality At the same time, the Forest's timber resources include a variety of products used by people of the San Luis Valley and beyond, from construction lumber to fuelwood, transplants and Christmas trees, posts and poles, wood for carving—even pinon nuts

Legal Framework

From a legal standpoint, the principal statutes governing timber management on National Forests are listed below

* The *Organic Act of 1897* (16 U S C 473-475) authorizes the Secretary of Agriculture to establish regulations governing the occupancy and use of National Forests, and to protect the forests from destruction

* *The Knutson-Vandenberg Act of 1930* (16 U S C 576-576b), as amended by the *National Forest Management Act of 1976* (16 U S C 472a), directs the Secretary to provide for improvement of the productivity of the renewable resources within National Forest timber sales areas. It authorizes the collection and use of timber receipts for these purposes.

* *The Multiple-Use, Sustained-Yield Act of 1960* (16 U S C 528-531) recognizes timber as one of five major resources for which the National Forests are to be managed It further directs the Secretary to develop and administer the renewable surface resources of the National Forests for multiple use and sustained yield of the many products and services obtained from these resources

* *The Roads and Trails Act of 1964* (16 U S C 532-538) directs the Secretary to provide for the existence of an adequate system of roads and trails within and near National Forests

* *The Small Business Act* (15 U S C 644) (as amended 1958) provides for agencies to participate in programs with the Small Business Administration This is the authority for the Small Business Timber Sale Set-Aside program

* *The National Environmental Policy Act (NEPA) of 1969* (16 U S C 4321) requires agencies to analyze the physical, social, and economic effects associated with proposed plans and decisions, to consider Alternatives to the action proposed, and to document the results of the analysis

* *The Forest and Rangeland Renewable Resources Planning Act* (RPA) (16 U S C 1600-1614) of 1974 (as amended by the *National Forest Management Act of 1976*) directs the Secretary to periodically assess the forest and rangeland resources of the

Nation, and to submit to Congress at regular intervals, recommendations for long-range Forest Service programs essential to meet future resource needs

* *The National Forest Management Act (NFMA) of 1976* (16 U S C 472a) sets forth the requirements for Land and Resource Management Plans for the National Forest System It also amended several Acts applicable to timber management It specifically addresses most aspects of timber management and how it is related to other resources NFMA is the primary authority governing the management and use of timber resources on the National Forests.

* *The Forest Resources Conservation and Shortage Relief Act of 1990* (16 U S C 620) sets forth restrictions on export of unprocessed timber originating from federal lands It addresses certain exceptions to export restrictions and establishes reporting requirements

Additional regulations also apply The rules governing the sale and disposal of timber are set forth at 36 CFR 223, Subparts A and B Subpart C governs suspension and debarment of timber purchasers, and Subpart D covers timber export and substitution restrictions The Chief's authority to manage and dispose of timber is delegated from the Secretary at 7 CFR 2 42 and described at 36 CFR 223 1 The text of these rules is set forth in Forest Service Manual (FSM) 1010

Historical to Present-Day Use

Historical documentation shows that specific areas of the Forest were used heavily for wood products During initial settlement by European settlers (1875 to early 1900s), impacts were felt in the lower-elevation forests from fuelwood gathering and limited construction (homes, fences) Later, lower- to mid-elevation forests, especially Douglas-fir, were heavily cut for railroad ties and mine timbers In the 1920s to 1940s, spruce forests were the target for sawlogs Physical evidence of such cutting practices can be seen throughout the Forest, though documentation of harvest levels for these periods is lacking

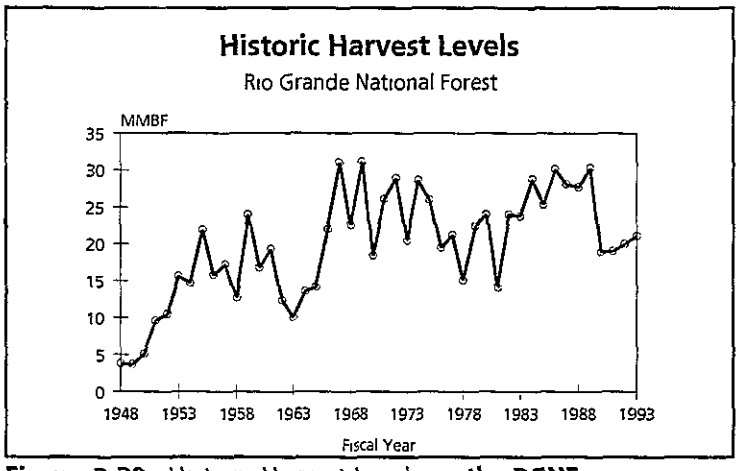


Figure 3-39. Historic Harvest Levels **on the RGNF.**

Actual harvest levels, both volume cut and acres treated, are available from about 1950 to the present (though some records exist from as early as 1920)

Since about 1950, about 150,400 acres, or 8 1% of the Forest, has been affected by harvesting Of the timber-covered area of the RGNF, 12 9% has been harvested From 1948 to 1993, timber sale sawtimber volume (live) sold averaged 19 7 million board feet (MMBF) per year (see Figure 3-39).

Tables 3-39 and 3-40 show acres harvested, per ten-year period, by species and silvicultural cutting method, respectively (Refer to Appendix K, Silvicultural Methods, for detailed descriptions of these methods) These records show some obvious trends While acreage of aspen harvested has remained fairly constant since the mid-1960s, harvested acreage of ponderosa pine and Douglas-fir has dropped, and harvested acreage of spruce-fir has increased During this period, clearcutting declined nearly 75% from its peak during 1965-1974, the use of shelterwood cutting has increased steadily since the mid-1960s, and group selection is a newcomer to the silvicultural methods used on the RGNF

Table 3-38 Acres Harvested by Cover Type (Species) per Ten-year Period
(included with this table are total acres per cover type found within the RGNF)

	COVER TYPE					
Ten-year Period	**Aspen**	**Ponderosa Pine**	**Doug-fir**	**Spruce/fir**	**Lodgepole Pine**	**Misc**
1985 -Present	1,949	145	4,252	57,764	3,921	45
1975 - 1984	1,451	884	5,326	44,522	566	41
1965 - 1974	1,913	1,385	5,792	19,315	2,161	274
1955 - 1964	513	2,211	5,016	13,345	1,447	401
prior to 1955	3,329	2,235	11,244	11,693	4,172	1,673
Total Area of Cover Type on the RGNF (acres)	264,629	37,986	201,385	572,034	30,643	73,021

Table 3-39. Acres Harvested by Silvicultural Cutting Method per Ten-year Period

	CUTTING METHOD							
Ten-year PERIOD	**CC**	**Swd Pr**	**Swd Sd**	**OR**	**ST Sel**	**Gp Sel**	**San/Sal**	**Thn/Imp**
1985 - Present	2,410	32,842	8,575	7,715	2,794	5,036	8,538	166
1975 - 1984	1,591	29,419	3,592	2,319	4,447	60	1,1213	149
1965 - 1974	9,039	13,160	15	4,421	1,503	0	2,144	558
1955 - 1964	3,926	11,836	243	1,324	465	0	5,139	0
prior to 1955	353	32,918	81	0	643	0	351	0

(Cutting Methods are CC=Clearcut, SWD Pr=Shelterwood Prep, SWD Sd=Shelterwood Seed, OR=Overstory Removal, ST SEL=Single Tree Selection, Gp SEL=Group Selection, SAN/SAL=Sanitation/Salvage, *Thn/Imp=Thinning/Improvement*)

[Note Both tables include areas that may have been entered for harvest more than once. For example, most shelterwood seed cuts have occurred in areas following shelterwood prep cuts Similarly, overstory removal cuts may have followed shelterwood seed and prep cuts]

From 1982 to 1991, Forest commercial sawtimber sale levels (live) averaged 28 MMBF per year Since 1991, sale levels have declined, in 1994, 5 4 MMBF was sold Over 80% of the

live sawtimber sold is spruce/fir The remainder is largely dead timber (usually Engelmann spruce), aspen, and lodgepole pine (Rideout 1992)

Demand for live timber from the RGNF and its timbershed from 1982 to 1991 averaged 50 MMBF, with the Forest consistently supplying 58% of total timbershed volume. (The Rio Grande Timbershed extends beyond the RGNF boundaries " . to include timber supply and demand elements from adjacent National Forests, and in some cases parts of adjacent National Forests The primary consideration in designing the timbershed is that timber sold in one part of the timbershed would readily substitute for timber sold in another part of the timbershed " Rideout 1992)

Demand exceeded supply by approximately 10 MMBF, due to a 20% shortfall in appraised volumes actually cutting out at the mills (Rideout 1992) Assuming sawtimber demand remains consistent with levels from the study period, current supply shortfalls could have dramatic effects on the wood-products industry in the RGNF timbershed (Rideout 1992)

From 1982 to 1991, dead timber volume cut and sold averaged one MMBF per year In addition, a few hundred thousand feet of aspen POL (products other than logs, such as posts, and poles) were harvested each year by clearcutting An average of 105 thousand board feet (MBF) of post and poles, 4 MMBF of fuelwood, and 4,000 Christmas trees was sold and removed annually (Rideout 1992).

It appears that the demand for small sales (volumes less than 250 MBF) and miscellaneous forest products is increasing Requests for posts and poles are now coming from as far away as Albuquerque, New Mexico Nearly 3 MMBF of other than commercial sawtimber was sold in 1994, and 1 1 MMBF of aspen POL was cut and sold in 1994

From a national perspective, the United States is a net importer of wood products U S citizens are the largest per capita consumers of wood in the world, using 25 percent of total global wood products U.S per capita use of wood has gone up by 30 percent during the last two decades (Salwasser 1991) These facts, combined with information from the Rideout study and recent sales of Forest products, point to a strong demand locally, regionally, and nationally for these products from the RGNF

Timber Product Measurement

The Forest Service has historically measured and sold sawtimber in board feet (most often represented in thousand board feet, or MBF) Rules for calculating board feet vary, depending on the size of the material to be cut, and do not account for the material smaller than that used for making boards (such as the tops of trees—topwood—or trees of pole-sized diameters) Cubic-foot-measurement rules are based on the actual wood fiber contained in a log, and accurately account for smaller material The Forest Service and RGNF began measuring and selling in cubic feet (usually in hundred cubic feet, or "cunits," and represented by CCF) in the early 1990s

References to volumes cut in the past will continue to be represented in board feet Current and future volumes will be represented in both cubic-foot and board-foot volumes

Factors Affecting Timber Resources

There are several factors influencing the current and future status of timber resources From a natural-resource standpoint, timber management activities have affected water quality and quantity, soils, fisheries, wildlife habitat, and disturbance regimes (fire and insects/disease)

Alternately, fire suppression is suspected to have had a strong influence on the Forest's timber resources—by alteration of fire frequency in fire-adapted cover types (ponderosa pine and Douglas-fir) and by changes in timber density and composition Such changes have also influenced the level and occurrence of insects and disease that parasitize forest trees (Refer to the sections on "Fire and Fuel Management"and "Forest Insects and Disease" for more information) Humankind's dependency on wood products will continue to be a primary factor influencing timber resources on the Forest

The 1982 *National Forest Management Act* (NFMA) regulations require the determination of the Forest's "tentatively suitable timber land" (TSTL) base and the "suitable timberlands" (STL) Suitable lands in a forest plan constitute the land base for determining the allowable sale quantity (ASQ) and the vegetation management practices associated with timber production

The process for identification of lands suitable for timber production involves asking a series of questions in relation to the capability and legality of a Forest's lands to grow trees Those questions, and the resulting classification of a Forest timber stand, are

Is the land forested? 36 CFR 219 14 (a)(1)

YES—go to next question NO—Unsuitable (nonforested)

Is the land withdrawn from timber production (e g , Wilderness)? 36 CFR 219 14 (a)(4)

NO—go to next question YES—Unsuitable (withdrawn)

Is the land capable of producing crops of industrial wood? FSH 2409 13-21 3
(i e , Are the species involved utilized or likely to be utilized within the next ten years?)

YES—go to next question NO—Unsuitable (nonindustrial wood)

Is irreversible damage likely to occur? 36 CFR 219 14(a)(2)
(i.e , Can timber production activities occur without irreversible damage to soils and/or watersheds?)

NO—go to next question YES—Unsuitable (irreversible damage)

Is adequate response information available to insure that the area be restocked within 5 years? 36 CFR 219 14(a)(3)

YES—tentatively suitable for timber production NO—Unsuitable (Restocking problems)

Is land selected in an Alternative (considering economics and land concerns) for timber production?

YES—then land is suitable and scheduled for timber harvesting

NO—Not appropriate (unsuitable

The TSTL is used as the starting point for determining the suitable timber lands (STL) for each Alternative The STL is different for each Alternative The difference in the STL among the Alternatives is based on the Management Prescriptions used in the Alternative and the financial and economic strategy of the Alternative Results from the TSTL evaluation, as seen in Figure 3-40, show that 38% of the Forest's land base is tentatively suitable for timber management.

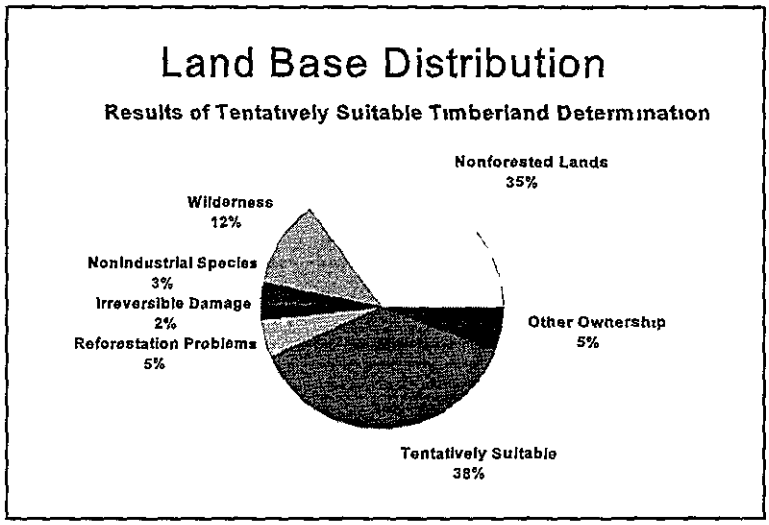


Figure 3-40. Land Base Distribution

The TSTL base is composed of both hardwood (aspen) and softwood (conifers, such as ponderosa pine or Douglas-fir) cover types Figure 3-41 illustrates this species composition The spruce/fir cover type comprises almost half of the TSTL A little over a quarter of the TSTL is aspen Figure 3-41 shows the TSTL on the Forest

Timber Resource Inventories

The Forest maintains and periodically updates the Resource Information System (RMRIS) database that contains important timber stand data Information in this database was gathered from intensive and extensive field surveys, aerial photos, maps, and other sources RMRIS is supplemented by an ARC-based Geographic Information System (GIS) Together, these systems contain information pertaining to inventory, growth and yield, structure

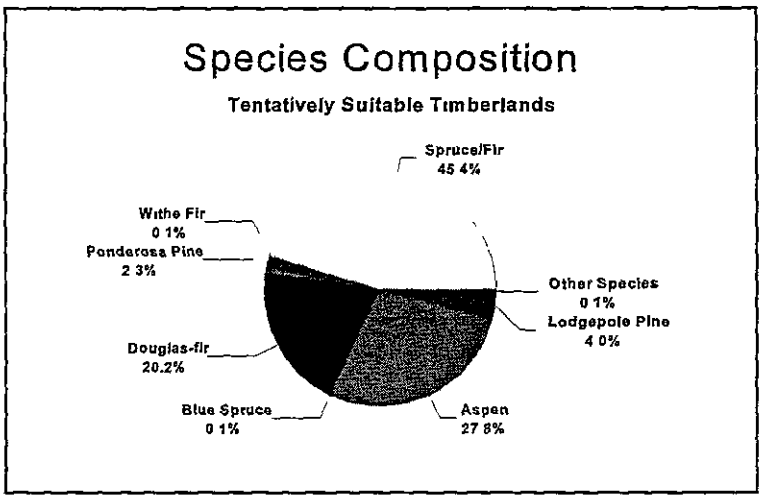


Figure 3-41. Species Composition

class, past activities, soil, geology and landform, and other geographic information that can be queried or updated daily

Suitable Timberlands

Figure 3-42 displays the tentatively suitable lands for the Forest Figures 3-43 through 3-48 display the suitable and scheduled timberlands for all Alternatives, except A, which has no suitable timber lands The maps also display the additional lands that could be entered if the Forest was ever to receive the full-implementation budget level

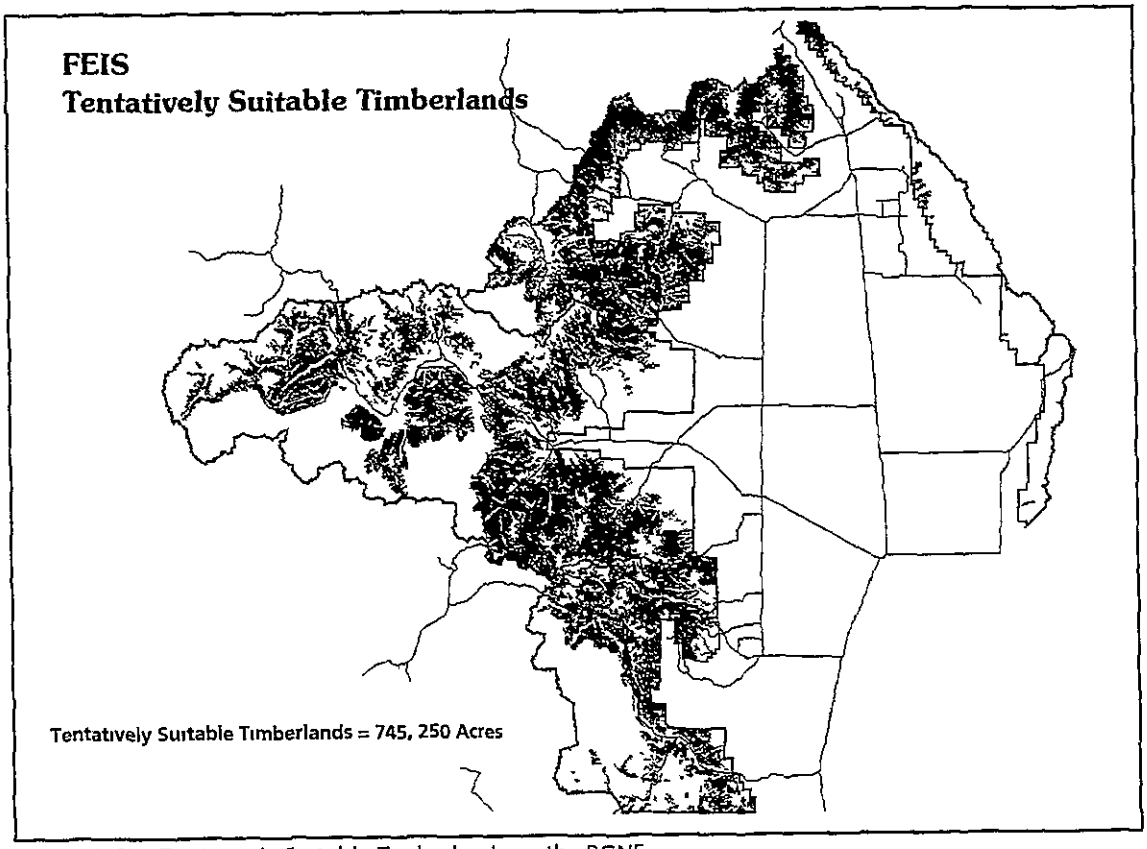


Figure 3-42 Tentatively Suitable Timberlands on the RGNF

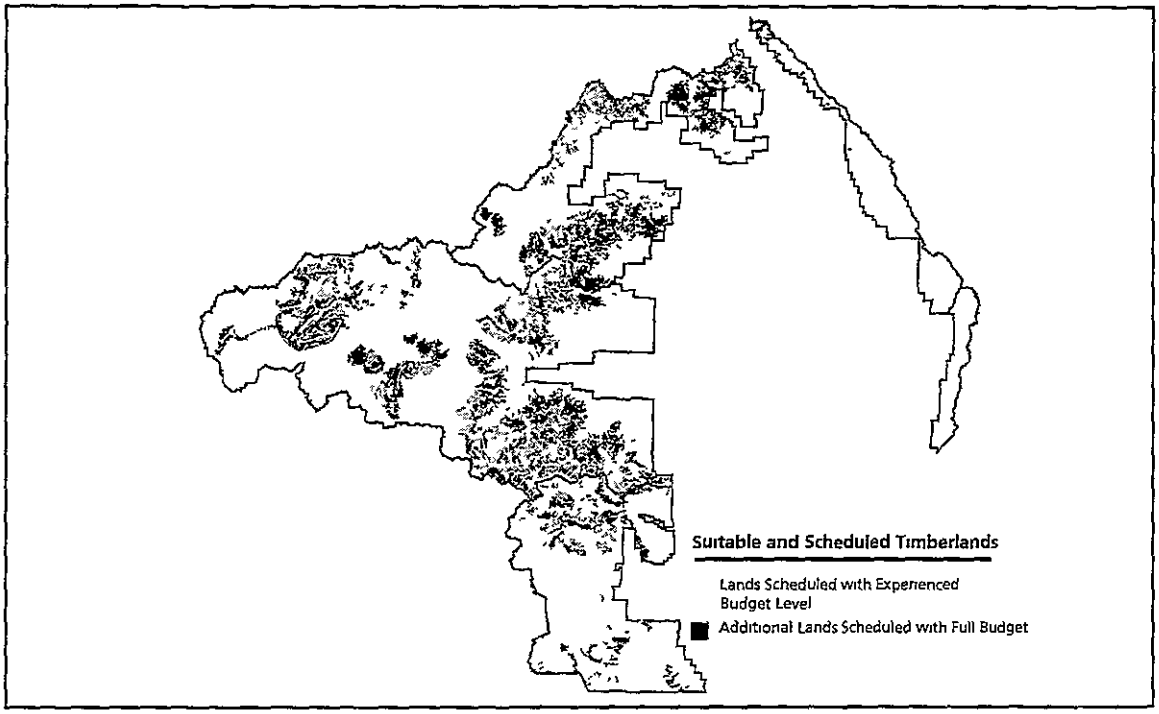


Figure 3-43 Alternative B-Suitable Timber Lands

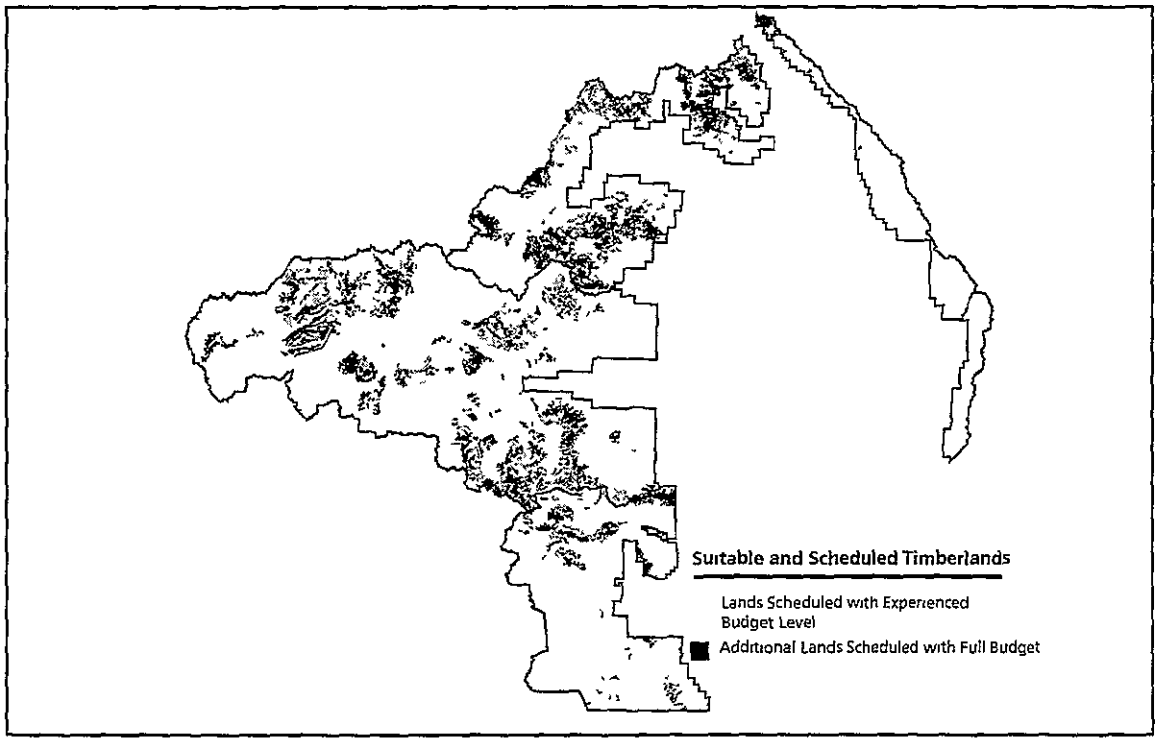


Figure 3-44 Alternative D-Suitable Timberlands

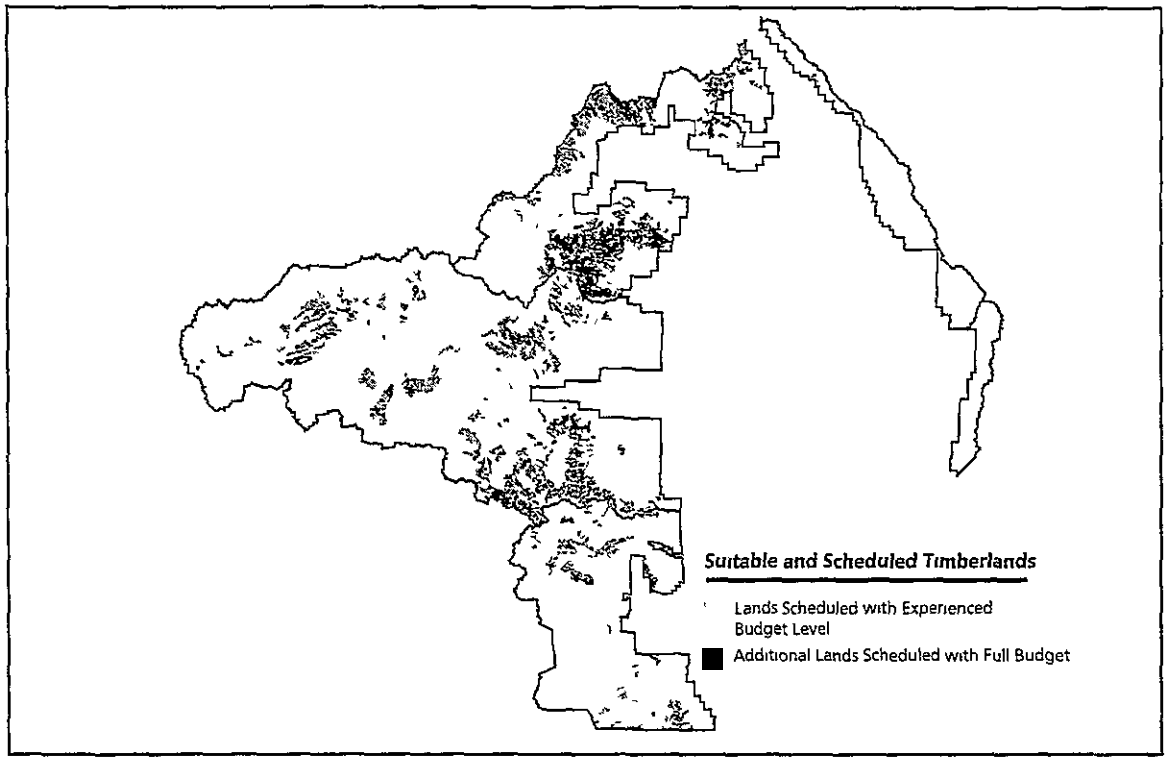


Figure 3-45 Alternative E-Suitable Timberlands

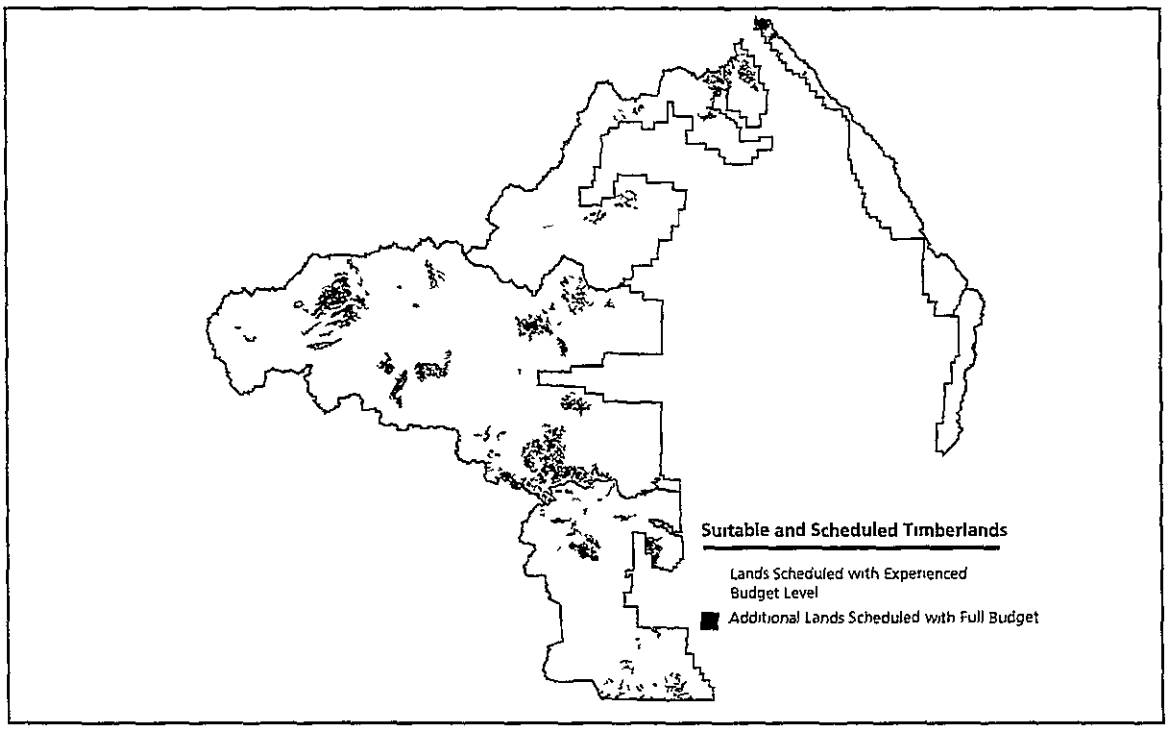


Figure 3-46 Alternative F-Suitable Timberlands

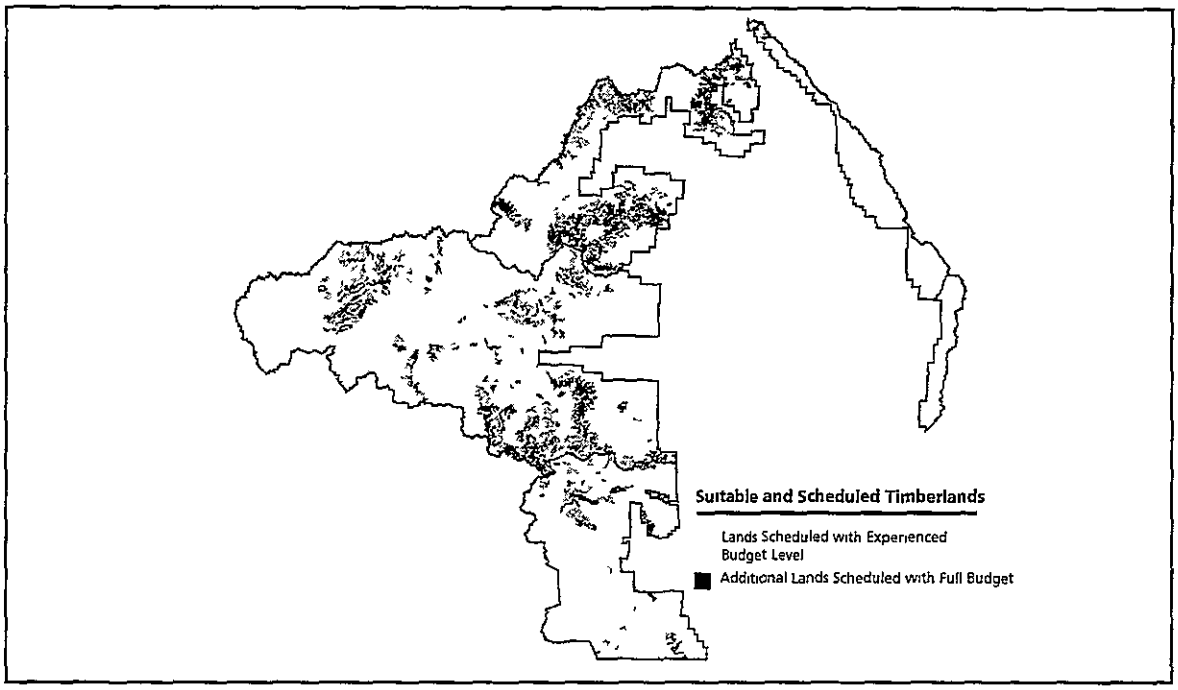


Figure 3-47 Alternative G-Suitable Timberlands

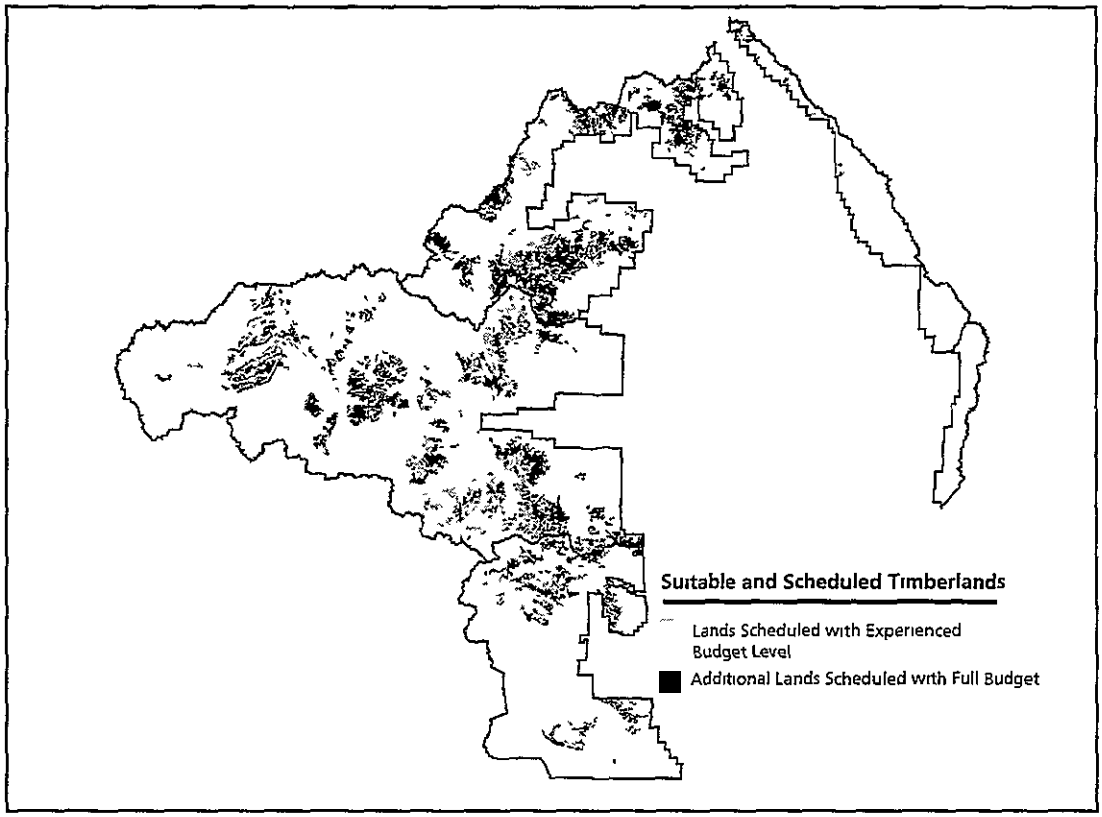


Figure 3-48 Alternative NA-Suitable Timberlands

Range of Natural Variability Conclusions

* Historical records give an incomplete, and sometimes biased, description of forested communities' distribution, composition, and structure

* Long-term climatic changes have directly influenced the distribution, composition, and structure of forested communities

* Short-term human influences, primarily fire suppression and wood-product removal, have directly influenced the composition and structure of forested communities

* Fire suppression has had the greatest influence on lower-elevation forest communities

AFFECTED ENVIRONMENT

This section emphasizes effects from the harvest of timber products (More information on timber resources can be found in various sections of this DEIS For general information on biological diversity, including information on forest cover types by province and tri-section, see "Ecological Resources" and "Biodiversity Assessment " For more detailed information on potential and existing forest vegetation, including information on ecological condition, disturbance processes, and potential production, see "Landtype Associations and Cover Types " Information on timber stand connectivity can be found in "Fragmentation and Connectivity " The Biodiversity Assessment specifically covers "Old-Growth Forests " Both "Forest Insects and Disease" and "Fire and Fuels Management" cover disturbance processes that influence, and are influenced by, timber resources Additionally, Appendix L contains information on silvicultural systems, logging systems, and the effects on timber resources of applying these various systems)

The forested area of the RGNF—that is, the area where vegetation is dominated by a tree-bearing overstory—can be broken into various cover types The cover types that dominate the RGNF are Engelmann spruce/subalpine fir, aspen, Douglas-fir, lodgepole pine, and ponderosa pine

As shown in Tables 3-16 and 3-17 in "Cover Types," the spruce/fir, Douglas-fir (mixed-conifer), and ponderosa pine cover types are heavily weighted in the mature and late-successional forest structure classes Both the aspen and lodgepole pine cover types have more stands in the sapling-pole structure classes than in the mature- or late-successional forest classes, but these two species are commonly found to reach maturity at diameters less than nine inches, especially on poorer sites Thus most of the RGNF forest stands have reached maturity

Often, as these stands have aged, their susceptibility to damage by fire or insects and disease has increased (Refer to "Fire and Fuel Management" and "Forest Insects and Disease" for more information)

The *Range of Natural Variability Assessment* (RNV) arrived at some basic conclusions relative to forested communities Ponderosa pine and Douglas-fir/mixed conifer stands on the RGNF contain more small-diameter, thin-barked stems of late seral species than may have been

seen before the settlement of European-origin peoples This is largely due to fire suppression Changes in ponderosa pine and Douglas-fir/mixed-conifer stands have increased the risk of stand-replacing fire, and of damage from the western spruce budworm, dwarf mistletoes, and root diseases.

Also, aspen-dominated stands were probably at historically high levels in the mid-1900s Currently, many of the Forest's aspen stands are at or near maturity. A slow, gradual conversion to conifer dominance can be seen in many aspen stands across the Forest.

The Alternatives include a range of management options for timber resources Forest trees can be affected directly by cutting, burning, weather (primarily windstorms causing windthrow), or infestation by insects or disease.

RESOURCE PROTECTION MEASURES

Specific resource protection measures for timber resources are found in Forestwide Goals and Objectives and Standards and Guidelines Additional protective measures are part of Standards and Guidelines specific to Management-Area Prescriptions

Other resource protection measures are included in Standard (B/BT section) and Special (C/CT section) Provisions of 2400-3(T) and 2400-6(T) Timber Sale Contracts All Alternatives provide for preserving the productive capability of timber stands

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

(The following effects assume funding/budget levels consistent with recent funding levels for the RGNF, unless otherwise noted For comparison purposes, some effects will be displayed for both experienced and full-implementation budget levels For information on the economic consequences of timber resource management, refer to the "Social and Economic" section)

Effects on Timber Resources from Timber Management

Effects Common to All Alternatives

Timber may be cut and/or removed to meet vegetation management objectives other than the offering of commercial products Those other objectives may be experimentation, hazard tree removal, wildlife habitat maintenance or improvement, or enhancement of scenic vistas, or to return conditions to within the range of natural variability Also, timber affected by natural mortality events (fires, windstorms, insect and disease infestations) may be harvested under salvage sales to serve objectives other than commercial product offering (e g , to reduce fuel loading or the risk of spread insects or disease). Commercial forest products may be a by-product of meeting these objectives The amount of timber cut and harvested to meet these objectives is expected to be low

There are no plans to harvest timber for purposes of experimentation Removal of timber to enhance scenic vistas has been done on a limited basis on the RGNF, yet so infrequently that we cannot predict the actual products arising from such activities Historically, some removal of hazard trees in and around developed recreation sites occurs every year on the Forest, but volume is generally low

Timber harvest may occur to reach desired conditions within the range of natural variability If analyses indicate that current vegetation differs greatly from historical norms, vegetative manipulation, including timber cutting, may be done to try to emulate natural patterns of composition and structure Timber products derived from this cutting could be sold commercially

Effects Common to Alternatives, Including Suitable Timber Lands

All Alternatives, except Alternative A, include suitable timber lands (STLs) On STLs timber may be cut and removed to meet Objectives consistent with Management-Area direction, while meeting growth-and-yield Objectives for the Forest's Allowable Sale Quantity (ASQ)

Harvesting must also meet management requirements in NFMA regulations (36 CFR 219 27) and be consistent with Forestwide Standards and Guidelines For Alternatives B, D, E, and G, STLs have been deemed appropriate for Management Areas (MAs) 4 21—Scenic Byways and Railroads, 4 3—Dispersed Recreation, 5 11—General Forest and Rangelands, 5 13—Forest Products, and 5 41—Deer and Elk Winter Range Alternative F includes STLs in these same MA's except that there are no lands allocated MA 5 13 The No Action Alternative includes STLs in MA's 1 31—Backcountry Recreation, non-motorized, 3 31—Backcountry Recreation, motorized, 3 56—Aspen Management, 5 13, 5 21—Water Yield Emphasis, 5.41, and 5 42—Bighorn Habitat.

Most of the Forest's ASQ, under both experienced and full budget levels, will come from spruce/fir stands Harvesting may occur in aspen, Douglas-fir, lodgepole pine, or ponderosa pine cover types, given full funding levels Particularly in ponderosa pine stands, which cover a small portion of the Forest area and have been the most altered by human influences, harvesting would be designed to favor the continued existence or expansion of ponderosa pine stands

The Forest will rely on natural regeneration of harvested sites for reforestation Stocking by natural regeneration is expected to be successful on 95% of harvested sites

Planting will be required for sites where final harvest removal cuts (such as patch clearcuts) have taken place on suitable lands, and minimum stocking requirements cannot be met from natural regeneration Stocking surveys will continue to be done at one-, three-, and five-year periods after sale harvest, to ensure that regeneration is taking place If it is not, planting activities will be undertaken Most planting on the RGNF is done manually using a combination of hoes, augers, or spades

Timber resource products, other than sawlogs, will be available due to activities tied to timber harvest or other management The cutting of posts, poles, and Christmas trees, and the removal of transplants or fuelwood, will occur The availability of these products will vary, depending primarily on access (Timber sale areas have traditionally been a major source for these products on the RGNF)

Effects Compared Between Alternatives

The effects discussed below focus primarily on acres actually harvested, and the resulting ASQ harvested from those acres "Acres harvested" includes those areas where trees were felled, skidded, and decked at landings (There may have been an occasional skid trail or landing that lay outside a cutting unit and was not included in this acreage Such exceptions are rare and largely avoided, because of the greater difficulty of administering sale contract provisions beyond cutting-unit boundaries Such exceptions are allowed only where needed to protect resources)

Acres harvested may not include all the acres in a stand where cutting has occurred, particularly in stands prescribed for patch clearcutting Patch clearcuts on the RGNF are often too small to be delineated as separate sites or stands A 100-acre stand may be prescribed for three-acre patch clearcuts scattered throughout the stand, comprising approximately 20% of the stand's acreage The effects of harvesting on that 100-acre stand are occurring on 20 acres This approach for displaying and discussing effects is more accurate than viewing effects in terms of stands affected

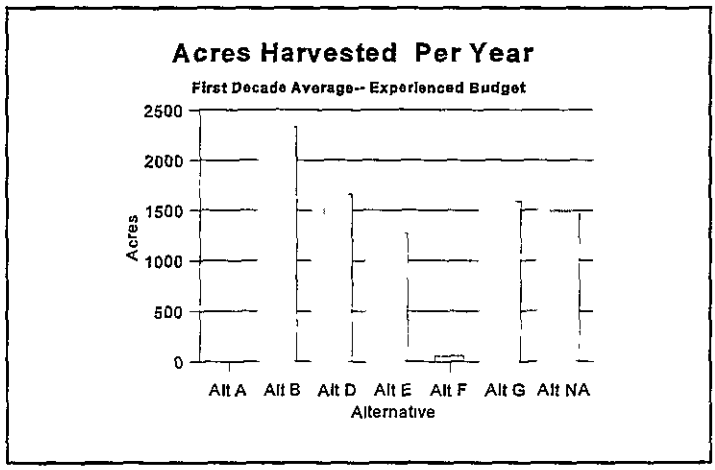


Figure 3-49 Acres Harvested per Year, First Decade Average with Experienced Budget

Alternative A allocates no suitable lands on the Forest Hence there will be no scheduled commercial timber sales, and no allowable-sale-quantity (ASQ) goal, for the ten-year period of the Plan

Assuming experienced budget levels, implementation of Alternative B would result in the most acres harvested and the greatest harvest volume (See Figures 3-49 and 3-50 for a comparison, across the Alternatives, of acres treated and ASQ

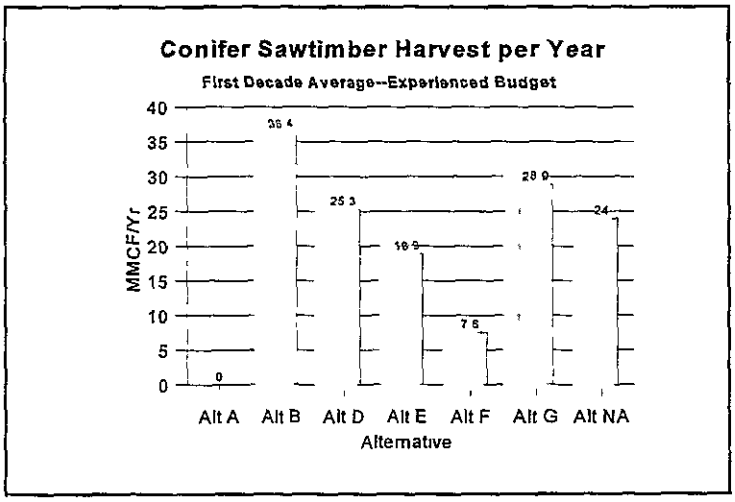


Figure 3-50 Conifer Sawtimber harvested per Year, First Decade average with Experienced Budget

Effects common to silvicultural harvest methods (and described in Appendix K) will be expected for the acres shown in Figure 3-51 In all Alternatives, harvesting will be dominated by shelterwood (both conventional and irregular) or group-selection harvest systems As a result, most Forest stands entered for harvest will continue to remain moderately dense, with a mix of single-layered, two-layered, or multi-layered canopies Stands not entered for harvest will continue, barring stand-wide disturbance, to increase in density and shift toward later successional conditions or stages

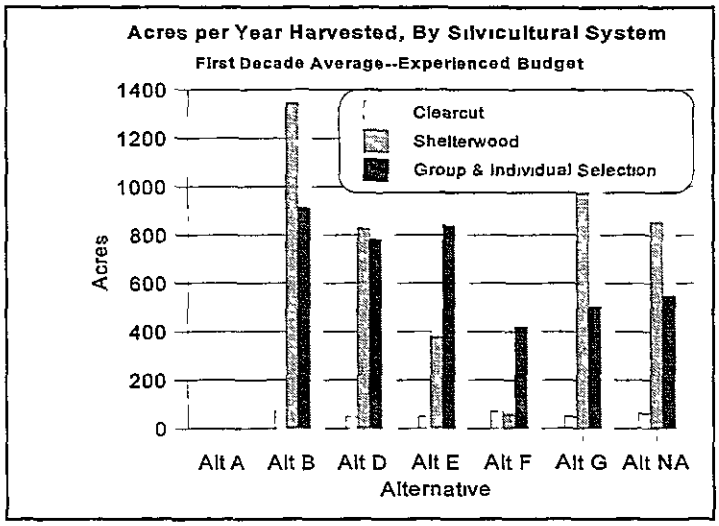


Figure 3-51 Acres per Year Harvested, By Silvicultural System

These conditions will generally favor, on a Forestwide basis, regeneration of subalpine fir over Engelmann spruce, white fir over Douglas-fir, and Douglas-fir over ponderosa pine Ponderosa pine, in particular, may have difficulty competing with Douglas-fir under these conditions

In harvested areas, objectives for controlling composition could serve to modify forest conditions and favor other species But with the limited area proposed for harvesting, this species composition control would occur over a small portion of the Forest Alternatives B, D, G, and NA would affect more acres under even-aged methods Alternatives E and F would result in more uneven-aged harvesting

Timber harvesting affects timber stand composition, structure, and density For example, a harvest treatment may be designed to (1) remove less desirable species (composition), (2) remove mostly small suppressed and large diseased trees (structure), (3) reduce competition among existing trees by thinning the stand (density), or (4) remove a mature (or older) timber overstory and regenerate a new stand (composition, structure, and density) These treatments can result in a change of structure class

The Forest predicts that about one out of every 20 acres harvested with a final harvest removal cut will not regenerate adequately within five years after harvest These areas will require planting (Table 3-40 displays the estimated acres needing planting, by Alternative and funding level)

Table 3-40. Acres of Reforestation, per Year, by Funding level

	ALTERNATIVE						
	A	B	D	E	F	G	NA
Experienced	0	117	83	64	28	80	73
Full	0	275	194	122	86	190	198

A limited amount of thinning is planned for most Alternatives Table 3-41 displays the estimated acres to be thinned, by Alternative and funding level (Some thinning is accomplished every year through administration of small posts and poles sales Most of this occurs in lodgepole pine stands on the Saguache Ranger District Also, thinning may be prescribed where insect or disease damage is apparent in understories, such as where western spruce budworm defoliation has caused topkill in white fir and Douglas-fir saplings and poles Such thinning will be done on an as-needed basis)

Table 3-41. Acres of Thinning, per Year, by Funding level

	ALTERNATIVE						
	A	B	D	E	F	G	NA
Experienced	0	105	75	57	25	72	66
Full	0	248	174	110	77	172	178

For the ten-year period of the Plan, road construction into unroaded areas (unroaded areas are greater than 5,000 acres, or greater than 500 acres and adjacent to Wilderness) is expected only in Alternative B, for a length of three miles One mile of road construction (outside unroaded areas) is expected in Alternative NA (Road construction into roadless or undeveloped areas may occur to greater or lesser degrees in future decades)

The result of such construction, for timber resources, will be conversion of forest ground to roadway, and the splitting up of forest stands by road corridors Actual forest acreage converted to roadway is estimated at 11 acres for Alternative B and three acres for Alternative NA

Road construction will enhance access to both sawtimber and other forest products For Alternative F, the net result of no road construction and the emphasis on closing of roads in Core/Core Restoration Areas, designated wildlife corridors, and Limited Use Areas will be a net reduction in timber sale roads Thus a minimal increase in land available for timber growth will occur in Alternative F

For the ten-year period of the Plan, Alternatives B and NA are expected to affect 415 and 298 acres of roadless areas, respectively

Availability of other forest products is expected to be highest in Alternative B as a result of more accessibility to greater volume of forest products Fuelwood and posts/poles will be by-products of sawtimber sales Figure 3-52 displays predicted personal-use fuelwood/post & pole volume for

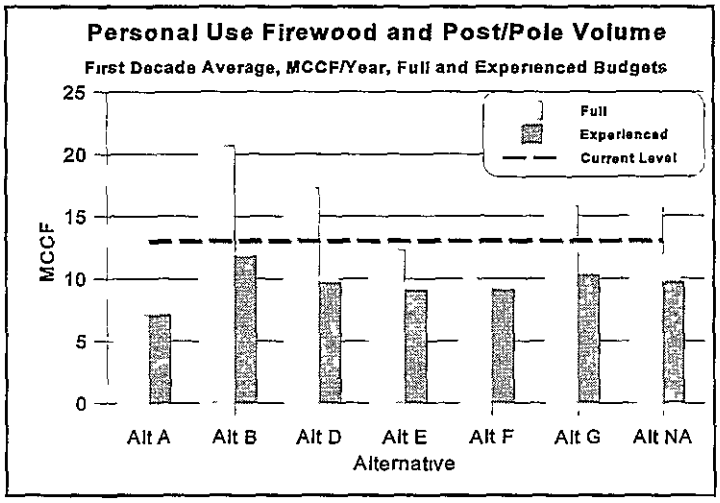


Figure 3-52. Personal Use Firewood/Post & Pole Volume

the Alternatives Currently, the three-year average volume is 13 0 MCCF (fuelwood-95%, posts/poles-5%) All Alternatives reflect a drop in volume from current levels If future demand for those products is consistent with current levels, a shortfall in supply would be expected The largest shortfall would be in Alternative A, followed by Alternatives F, E, D, NA, G, and B Alternatives A and F assume that human uses will be subordinate to ecosystem process, hence the projected shortage of these products would be alleviated only through vegetative manipulation tied to other Forest objectives Assuming that half of all fuelwood and posts/poles comes from current and former timber sale areas, we estimate that 121 acres of mixed-conifer and aspen stands would have to be clearcut (or a proportionately larger area partially cut) to meet the expected shortage of these products in Alternative A Comparatively lesser acreage would need to be cut in other Alternatives to satisfy current demand

The reduction in late-successional-forest acreage from harvest disturbances will be greater in Alternative B than other Alternatives A similar trend in snag reduction is expected, because of the necessity of removing snags for reasons of safety in areas where logging personnel are working Overall, the Forest would retain snag numbers well above the minimum Plan Standards Alternative A would result in the least disturbance of late-successional Forest acreage, and snags, from harvest disturbances

The cutting of Christmas trees and the removal of aspen transplants are still expected under all Alternatives Alternatives A and F would emphasize such removal to meet other resource objectives Due to the net loss of timber sale road access under Alternative F, the availability of these products will be less than other Alternatives (The actual proportion of road access affected is very small when viewed in the context of the entire Forest's road network)

Accumulations of coarse woody debris (CWD) can vary greatly, due to normal processes of growth, decay, and natural disturbances, such as fire Harvest activities can cause light to heavy increases in CWD found on the forest floor Alternative B will cause greater CWD accumulations, as a result of timber harvesting, than other Alternatives Alternative A is expected to have the least increase of CWD from timber harvesting

Due to the predominant use of shelterwood (both conventional and irregular) and group-selection methods across all Alternatives, CWD accumulations resulting from harvesting will generally be light to moderate, and dispersed throughout harvested areas With the predicted shortage of fuelwood, personal-use and commercial-fuelwood gatherers could be directed to areas with concentrations of CWD, to reduce unnatural accumulations Additionally, under all Alternatives, shortages in fuelwood availability should result in increased removal of CWD along Forest roads

Only Alternative NA includes the allocation of lands to Management Prescription 5.21 (Water Yield Emphasis), which stresses increased water yields through vegetative manipulation In reality, increased water yields have been proven to occur from all types of timber harvest, with increases proportional to the degree of cutting (i e , greater increases with heavier cuts, lesser increases with lighter cuts) Increased water availability on forested sites can result in more available water for tree growth, though growth increases would go largely unnoticed

Watersheds exhibiting unnatural erosion as a result of timber management activities are expected, over the ten-year period of the Plan, to revegetate and stabilize to some degree

With roads being the greatest source of eroding sediment on timber sales, these roadways should be releasing less sediment as time passes. Where suitable timber lands are within "watersheds of concern," future timber sale scheduling has been delayed to allow some rest and rehabilitation of these lands Harvesting could occur sooner, if actual field observations reveal more rapid stabilization and rehabilitation than expected

ASPEN

This FEIS includes aspen sawtimber as a separate noninterchangeable component (NIC) Assuming experienced funding levels, no aspen harvesting is expected under any Alternative. The Forest has cut about 500 acres of aspen over the last three years, both to supply wood products (primarily fuelwood) and for wildlife habitat enhancement

There is a demand for aspen fuelwood every year. In years when the Forest provides less-than-normal amounts of aspen fuelwood, requests for aspen fuelwood from state lands increase, especially around the La Jara Reservoir tract.

Demand for aspen sawtimber has been sporadic, and generally low, in past years The Forest can sustainably harvest about 11 MCCF/Year of aspen (Alternative G) For this to happen, commercial demand would need to increase, as well as the bid price Generally, the Forest will not sell aspen sawtimber below cost

All Alternatives assume that some level of aspen stand maintenance will occur. Future harvesting of aspen stands, or conversion of coniferous stands to aspen, will be based on landscape-scale analyses Such analyses will tie future aspen management activities to existing deviations from reference conditions, to the condition of existing stands, and to the resource emphasis of the affected Management Area The area to be cut on an annual basis is expected to be small Therefore, aspen stands should exhibit a range of structure classes across the Forest, with the majority of those stands in mature to late-successional classes

Tables 3-42 and 3-43 display summaries of Timber Sale Program Quantity for all Alternatives for the ten-year period of the Plan

Table 3-42 . Timber Sale Program Quantity (TSPQ) for first decade, in MCCF, by Budget Level

VOLUME COMPONENT [1]	BUDGET LEVEL	ALTERNATIVE A	B	D	E	F	G	NA
Conifer Allowable Sale Quantity (ASQ)	Experienced	0	364 5	252 8	189 5	75 6	288 7	239 6
	Full	0	674 3	516 4	312 1	168 7	518 7	481 2
Hardwood Allowable Sale Quantity (ASQ)	Experienced	0	0	0	0	0	0	0
	Full	0	180 9	171 7	103 2	71 8	111 9	141 9
Personal Use Firewood (PUF)	Experienced	67 4	111 7	92 3	87 0	86 5	98 1	92 3
	Full	67 4	196 8	164 8	117 2	90 9	149 9	150 6
Other Products (OP)	Experienced	3 6	5 8	5 0	4 4	4 4	5 3	5 0
	Full	3 6	10 4	8 5	6 2	4 8	7 9	8 0
Other Vegetation Management (OVM)	Experienced	5 3	5 1	5 5	5 7	5 1	5 0	5 2
	Full	5 3	5 1	5 5	5 7	5 1	5 0	5 2
Salvage (SAL)		--- None Planned ---						
TSPQ TOTAL	Experienced	76 3	487 1	355 6	286 6	171 6	367 1	342 1
	Full	76 3	1067 5	866 9	544 4	341 3	763 4	786 9

1 OP are non-sawtimber, from suitable lands—mostly post/poles
OVM is volume from unsuitable lands, to meet other resource objectives
SAL is dead and/or dying timber, from suitable or unsuitable lands

Table 3-43 . Timber Sale Program Quantity (TSPQ) for first decade, in MMBF, by Budget Level

VOLUME COMPONENT [1]	BUDGET LEVEL	ALTERNATIVE A	B	D	E	F	G	NA
Conifer Allowable Sale Quantity (ASQ)	Experienced	0	150	94	65	30	110	94
	Full	0	256	215	124	76	210	187
Hardwood Allowable Sale Quantity (ASQ)	Experienced	0	0	0	0	0	0	0
	Full	0	32	10	10	10	18	23
Personal Use Firewood (PUF)	Experienced	24	40	33	31	31	35	33
	Full	24	66	54	38	32	55	51
Other Products (OP)	Experienced	1	2	1	1	1	2	2
	Full	1	3	2	2	2	3	3
Other Vegetation Management (OVM)	Experienced	2	2	2	2	2	2	2
	Full	2	2	2	2	2	2	2
Salvage (SAL)		--- None Planned ---						
TSPQ TOTAL	Experienced	27	194	130	99	63	149	131
	Full	27	359	283	176	122	288	266

1 The use of MMBF for many of these products is for comparison purposes only Many of these products are sold in either cubic or cord volumes Many are have small diameters, and have no board foot volume
OP are non-sawtimber, from suitable lands—mostly post/poles
OVM is volume from unsuitable lands, to meet other resource objectives
SAL is dead and/or dying timber, from suitable or unsuitable lands

Effects on Timber Resources from Recreation

All Alternatives involve some construction of campgrounds and trailheads, and expansion of existing campgrounds Trees would be cut and cleared, but only enough to allow safe construction and effective use of these facilities We estimate the timber product volume derived from these activities at 39 CCF (14 MBF) per year

Where recreation impacts are heavy (such as in campgrounds, near trailheads, or near heavily used dispersed sites), existing trees will be damaged by cutting, scarring, and soil compaction As a result, individual dead and/or dying trees may be cut These individual trees are so scattered and infrequent, and their volume so minimal, that the volume has not been estimated

Some expansion of the Wolf Creek Ski Area is expected in the ten-year period of the Plan Timber will have to be cut for the placement and operation of new facilities (such as ski lifts), and some timber may be removed for ski runs if expansion is approved The expected volume of timber cut and removed for these purposes is estimated at 998 CCF (360 MBF)

Timber harvest is limited in viewsheds (visible) near heavily used recreation corridors, use areas, lakes, or campgrounds.

Effects on Timber Resources from Wilderness

Alternatives A, E, and F include areas recommended for Wilderness designation These recommendations reduce the area on the RGNF where vegetative manipulation can occur Wilderness designations for these areas would effectively preclude the harvesting of any timber products There are no Wilderness recommendations for Alternatives B, D, G, and NA. Table 3-44 displays the acres removed from the TSTL because of lands recommended for Wilderness

Table 3-44. Acres Removed from TSTL because of lands recommended for Wilderness

Alternative	Acres Recommended for Wilderness	Recommended For Wilderness & TSTL
A	506,160	262,032
E	104,950	45,570
F	197,710	84,550
B, D, G, NA	0	0

Effects on Timber Resources from Travel Management

Construction and reconstruction of roads are expected to be minimal in proportion to the Forest area A proposal to widen about 3 5 miles of US highway 160 would result in 1 4 MCCF (5 MMBF) of timber volume removed Additionally, the RGNF, on an infrequent basis, will grant right-of-way (ROW) easements or temporary road use to private individuals for access to their inholdings within the Forest's boundary It is estimated that three ROW timber sales will occur during the ten-year period of the Plan, resulting in about 38 acres of treatment and 1 2 MCCF (45 MMBF) of sawtimber harvested

The closing of existing roads will allow old roadways to revert to natural vegetation, including regeneration of tree species Any growth of tree species on these closed roads will be slow and inconspicuous during the ten-year period of the Plan

Effects on Timber Resources from Fire Management

RGNF fire history data indicate that there were numerous small fires and infrequent large ones Thus implementing Alternatives A or F, which emphasize allowing natural processes to occur, could result in fires damaging or killing trees on very limited acres or across many acres, depending largely on climatic conditions Salvage and/or sanitation cutting might be deemed necessary after fires.

The application of management-ignited fire (MIF) for natural-fuel treatment of 1,200-3,000 acres per year, under all Alternatives, in the ponderosa pine cover type could result in thinning ponderosa pine stands, favoring pine over other mixed-conifer species, reducing CWD and other potential fire fuels, and reducing competition on pine-growing sites from other vegetation

Effects on Timber Resources from Insect and Disease Management

Under Alternatives A or F, insect and/or disease infestations will be allowed to run their course As with fire, disturbances from insects and disease have generally occurred frequently over small areas and infrequently over large ones

Depending on the severity of an infestation, effects on timber resources could vary widely The infrequent large disturbance event, such as the spruce beetle outbreak that occurred on the Divide Ranger District from 1980 to 1985, can dramatically alter timber stand structure and composition, sometimes resulting in large areas of standing dead or dying trees This level of infestation is not expected in the ten-year period of the Plan Predicting the effects on timber resources is not possible

Under all Alternatives, the potential exists for salvage/sanitation cuts to harvest dead and damaged timber, and to attempt to slow or impede infestations from spreading The degree to which these harvests are undertaken will largely depend on the risks associated with wildfire potential, infestation spread into healthy stands, public safety, the presence of high-value resources, and the resource emphasis of the infected or adjoining area

Effects on Timber Resources from Special Area Designation

Timber harvesting is not permitted in areas recommended for Wilderness, nor in Research Natural Areas No Special Interest Areas are included in the tentatively suitable timber base Concurrently, with natural processes allowed to occur unabated in these areas, disturbance events (like those described under "Effects on Timber Resources from Fire Management," and "Effects on Timber resources from Insects and Disease Management") would be anticipated

Effects Resulting from Increased Funding Levels

In the unlikely event that funding levels would increase substantially to fulfill budget needs for full implementation of the Alternatives, Figures 3-53 through 3-55 display the changes in effects that will be expected The relative ranking of effects (most to least, highest to lowest) among the Alternatives, as previously discussed under expected funding levels, will not change appreciably Under all Alternatives (except A), full funding would result in about twice as many acres harvested, and about double the conifer sawtimber volume, as compared to experienced levels Table 3-42 displays experienced and full budget levels for fuelwood and posts/poles, plus the current three-year average) level Assuming full funding, either Alternatives B, D, G, or NA would result in increasing amounts of these products All other Alternatives would result in levels below the current level

Notable differences between full and experienced funding levels are the increase in road construction and roadless-area entry with the additional funding, and the harvest of aspen sawtimber volume

Regardless of funding levels, there would be no roadless-area entry in Alternatives A, E, or F Fully funded, the Forest would expect the following acres affected in roadless areas Alternative B—64, D—558, G—13, NA—49

Recall that no aspen sawtimber harvest was expected under experienced funding levels Figure 3-55 displays the amount of aspen sawtimber volume harvested, by

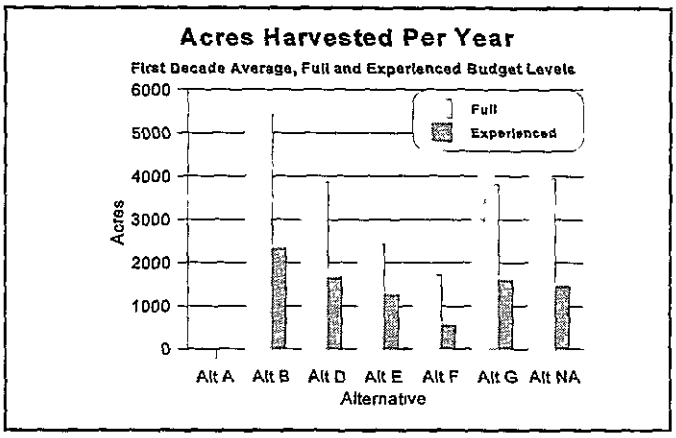


Figure 3-53 Acres Harvested by Budget Level

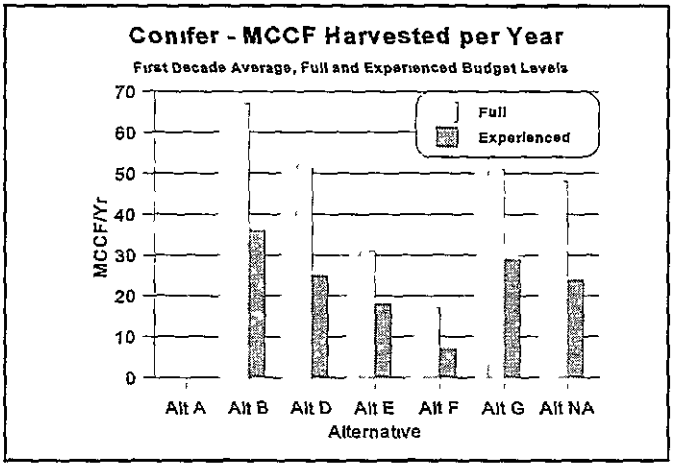


Figure 3-54 Conifer Harvested Per Year by Budget Level

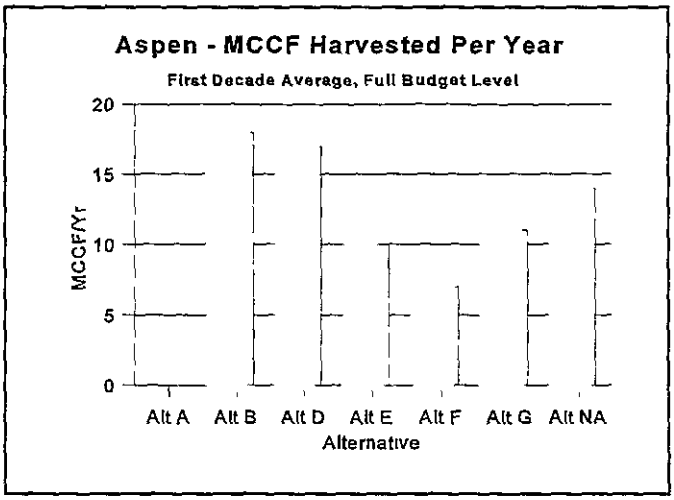


Figure 3-55 Aspen Harvested per Year, Full Budget Level

Alternative, under full funding with amounts varying from zero volume (Alternative A) to 18 1 MCCF per year (Alternative B)

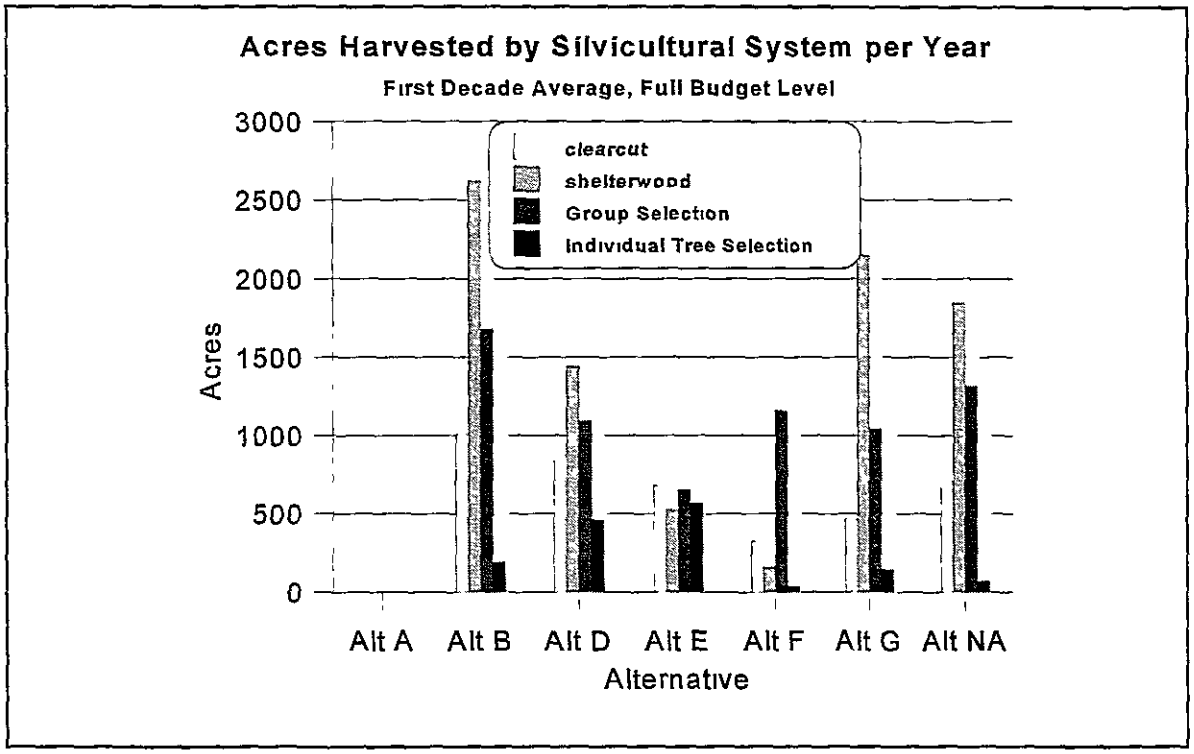


Figure 3-56 Acres Harvested by Silvicultural System, Full Budget Level

CUMULATIVE EFFECTS

Effects from Timber Management on Lands Adjoining the RGNF

Private Lands: Private lands are scattered throughout the Forest, many tracts containing small but valuable stands of timber It is not known how much these lands have been affected by harvesting, but total acreage is small and cumulative impacts are minimal

State-Owned Lands: There are scattered tracts of state lands both within and next to the RGNF Most are discrete 640-acre sections dispersed around the perimeter of the Forest The largest tract adjoining the Forest encircles La Jara Reservoir, and is bounded by the Conejos Peak Ranger District on roughly three sides This area encompasses about 35,000 acres, an estimated 12,000 of which are timber-covered

Most of the forested stands on nearby state-owned lands have been harvested The past few years have seen harvesting on most timber stands within the La Jara Reservoir tract Harvesting has included a variety of overstory-removal, diameter-limit cuts (where all merchantable trees over a specified diameter, say 10 inches, are cut, releasing smaller trees for future growth), and shelterwood cuts In the last five years, an average of 120 acres has been harvested per year in a mix of shelterwood cuts in mixed-conifer stands, patchcuts in spruce/fir stands, and fuelwood patchcuts in aspen Harvest cutting has been done primarily

for wildlife habitat maintenance and enhancement, and for timber products Additionally, some thinning and burning have been accomplished

Federal Lands: The Bureau of Land Management (BLM) administers about 7,000 acres of commercial forestland in the San Luis Valley (SLV) These forests contain about 17 MMBF of standing sawtimber The volume sold annually is small, averaging 0 12 MMBF for the period 1987 to 1991 All of the BLM's commercial forestlands are considered winter range for big-game animals, therefore, cuts are designed to enhance wildlife use of these lands

Harvesting has occurred on all National Forests bordering the RGNF A considerable buffer lies between harvested acres on the San Juan and those on the RGNF Limited harvesting has occurred on the Carson NF near the RGNF's southern boundary On the Saguache RD, harvest units lie next to harvested areas on the Gunnison NF, along the Continental Divide The San Isabel NF has harvested some stands approximately two miles away from harvested areas on the Saguache RD

Total acres harvested of forested stands within the RGNF has amounted to about 150,000 acres, or about 8 % of the entire Forest, since records have been kept. Most of these acres have been partially cut (i.e , a portion of the overstory has been removed), generally leaving half or more of the original overstory. Only clearcut and overstory-removal methods result in removing all of the overstory (Overstory removal generally releases for growth a fully stocked understory) These methods have been used on 1 7% of the Forest Of that area, 1 3% has been regenerated with young trees The remaining 4% are mostly areas harvested in the last three years, regeneration of these areas is expected to be successful

All other harvested areas have retained some amount of residual large trees, allowing younger trees to grow up underneath or adjacent to the overstory, while maintaining a mature forest cover As a result, a mature forest cover has been maintained on the bulk of the acres harvested. For the next decade, assuming funding remains consistent with recent levels, the most acres affected by harvesting (Alternative B) is 23,340, or 1 3% of the Forest Most of this harvesting would occur in areas previously entered.

Assuming greatly increased funding for full implementation of any Alternative, Alternative B would result in 55,036 acres affected, or 3% of the Forest, again including many areas previously entered Assuming that the Alternative representing the greatest area and degree of harvest (again, Alternative B) were implemented over the next ten-year period, added to harvesting that has occurred on adjacent private, state, and other federal lands, the cumulative impacts of harvesting throughout the RGNF region will have occurred on less than 10% of the land, while retaining an intact, mature forest on most of those acres Forest growth and renewal have concurrently occurred during past and present harvest activities Further planned harvesting is characterized by light and widely dispersed cutting

The cumulative effects on the Forest's forested communities from implementing any of the Alternatives, in the ten-year period of the Plan, will be minimal in respect to the range of natural variability Planned harvesting will mostly influence the spruce/fir cover type, within the Engelmann Spruce on Mountain Slopes LTA This influence is over such a small percentage of forest area that it might be seen as emulating the magnitude of disturbance that occurs through natural processes

Irreversible and Irretrievable Commitment of Timber Resources

The construction of collector roads to be used as primary transportation routes on the RGNF commits the actual roadway surface to traffic use and in essence precludes the growth of trees These roads can be obliterated at some future time, allowing the trees to grow back on these sites, but in reality such an action is unlikely to occur once these routes are established

Alternatives that recommend Congressional Wilderness designation result in the prohibition of timber management on those lands Similarly, the designation of Research Natural Areas (RNAs) precludes timber management for as long as the RNA remains in place Some Management Prescriptions restrict or prohibit timber management, but such restrictions could be lifted with a change in allocation in the next Plan Revision

The forested communities on the RGNF suspected to have been altered the most by humankind's influence are the ponderosa pine, Douglas-fir/mixed conifer, and aspen communities. Fire suppression has been the most influential factor in the alteration of these forests Harvesting and domestic livestock grazing are also thought to have changed stand structure, composition, and function (Covington, 1994). Assessing which Alternative is the most, or least, effective in shifting these forest communities toward their "natural" condition may not be possible, because not enough is truly known about "natural" conditions or about ecological functions, such as disturbance processes, in the area encompassed by the RGNF

Allowing disturbance processes (fire, and insects and disease) to occur without interference (as in Alternative A, and to a lesser degree Alternative F) could result in dramatic shifts outside the range of natural variability (e g , extensive stand-replacing fires) In reality, large disturbance events could occur regardless of the Alternative selected for guiding the management of the Forest Such intense, broad-scale disturbances are not expected to occur, however, during the ten-year period of the plan

Only through continuing efforts of assessing the ecological composition, structure, and function of forested communities at various scales, and monitoring and evaluating people's influences in the context of "naturally-occurring" interactions, can we begin to better understand where the RGNF's lower- to mid-elevation forests are, relative to the range of natural variability Such efforts, implemented with this Plan, will likely need to persist for many years beyond the next 10, to offset the effects of 90 years of fire suppression and other human influences on the Forest

RANGE RESOURCES

ABSTRACT

Rangelands on the RGNF not only provide forage for both livestock and wildlife, but also are wildlife habitat and the setting for a variety of outdoor recreational experiences

The livestock industry began to graze the RGNF as early as the 1850's The combination of uncontrolled livestock use and high numbers of livestock, both prior to and after the establishment of the Forest, has affected range condition and plant composition

There are about 577,000 acres of land on the Forest identified as suitable for livestock grazing Big game and livestock require about 128,700,000 pounds of forage per year The alternatives estimate forage at varying levels. Roughly 70,480 Animal Unit Months (AUMs) for wildlife and 81,940 AUMs for livestock will be available each year

INTRODUCTION

Legal Framework

There are multiple laws that direct grazing activities on NFS lands The *Multiple-Use Sustained Yield Act of 1960* provides that the National Forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes

The *Forest and Rangeland Renewable Resources Planning Act of 1974* (Section 6, (g)(2)(a)) specified that the Secretary of Agriculture was to promulgate regulations that set out the process for the development and revision of land management plans, which would require the identification of the suitability of lands for resource management

The *Federal Land Policy and Management Act of 1976* states that public lands will be managed in a manner that will provide food and habitat for fish, wildlife and domestic animals.

The *National Forest Management Act of 1976* allows the Forest Service to assess present and anticipated uses of the nation's public and private forests and rangelands

The *Public Rangelands Improvement Act of 1978* recognized the need to correct unsatisfactory conditions on public rangelands by increasing funding for maintenance and management of these lands

The Code of Federal Regulations contains several provisions dealing with range capability and suitability Specifically, 36 CFR 219 3 provides detail definitions and terminology, as follows.

Capability: The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity Capability depends on current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices, such as silviculture, or protection from fire, insects, and disease

Suitability: The appropriateness of applying certain resource management practices to a particular area of land, as determined by an analysis of the economic and environmental consequences and the alternative uses foregone A unit of land may be suitable for a variety of individual or combined management practices

36 CFR 219.20 contains the following direction about grazing resources in Forest planning

In forest planning, suitability and potential capability of National Forest System lands for producing forage for grazing animals and for providing habitat for indicator species shall be determined as provided in paragraphs (a) and (b) of this section Lands so identified shall be managed in accordance with direction established in forest plans

(a) Lands suitable for grazing and browsing shall be identified and their condition and trend shall be determined The present and potential supply of forage for livestock, wild and free roaming horses and burros, and the capability of these lands to produce suitable food and cover for selected wildlife species shall be estimated The use of forage by grazing and browsing animals will be estimated Lands in less than satisfactory condition shall be identified and appropriate action planned for their restoration

(b) Alternative range management prescriptions shall consider grazing systems and the facilities necessary to implement them, land treatment and vegetation manipulation practices, and evaluation of past problems, possible conflict or beneficial interactions among livestock, wild free-roaming horses and burros and wild animal populations, and methods of regulating these, direction for rehabilitation of ranges in unsatisfactory condition, and comparative cost efficiency of the prescriptions

The NEPA decision associated with the development of Allotment Management Plans authorizes livestock grazing on specified areas The number and kind of livestock and season of use are determined at this stage of planning through site-specific range analysis Determining suitability at the project level should not be mandatory and should be completed only when capacity is an issue

Suitability Determination

The RGNF has used the definitions and interpretation above as the basis for determining suitability of its rangelands In addition, the *Rangeland Analysis and Management Training Guide* (RAMTG 1994) was used as a source for interpreting the above direction

"Capable" rangeland is accessible to livestock, produces forage or has inherent forage producing capabilities, and can be grazed on a sustained basis Range analysis handbooks have traditionally referred to suitability analysis when by definition capability analysis was closer to what was accomplished

Noncapable rangeland includes areas that should not be grazed by livestock because of unstable soils, steep topography (> 40% slope), lack of management improvements, or inherently low potential for production The preceding sentence makes use of the

definition in the Forest Service Manual of unsuitable range, which deals mainly with physical or biological capability

Those criteria are used on the RGNF for non-capable rangelands

* excessive slope (>40%), length of slope, and natural barriers;

* soil- and vegetation-characteristic limitations (loose granitic soils, erosive soils, areas of low vegetative cover, boggy areas),

* areas that would otherwise be suitable except for lack of range improvements (no boundary fences with lands open for miles, lack of water within three miles, etc); and

* areas of rock, road, water surface, and other barren locations

Lands can be closed to grazing use by a line officer administrative decision, the Forest Plan, Executive Order, Order of the Secretary of Agriculture, Act of Congress, or other means Lands that have been or can be closed to grazing include administrative sites, fenced recreation sites, fenced highway rights-of-way, designated management areas or parts thereof (Research Natural Areas, Experimental Forest Areas), watershed (for domestic use, etc), areas inside of city limits, and other sites

All lands not in the categories listed above are considered capable, relative to the physical characteristics

Biological characteristics are examined as part of the biological flora and fauna portions of the Forest Plan EIS No areas have been determined to be non-capable for the grazing of livestock for biological reasons, although local areas can be closed for the enhancement of a particular species of plant or animal

The number of acres capable of supporting livestock grazing on the Rio Grande National Forest are listed in Table 3-45

Environmental Suitability

The capability analysis determined which lands are physically or biologically capable of being grazed Under 36 CFR 219 20, suitable National Forest System lands shall be determined. Thus all Forest lands were analyzed as being suitable or unsuitable for grazing or browsing The suitability analysis identified where grazing is appropriate, considering rangeland conditions and the other uses or values of the area The analysis also identified areas where grazing is not appropriate Additionally, uses foregone were also analyzed, relative to their effect on livestock resource management

The areas that have been determined not appropriate for livestock grazing have been closed administratively Lands that have been or can be closed to grazing include administrative sites, fenced recreation sites, fenced highway right-of-way, designated management areas or parts there of (Research Natural Areas, Experimental Forest Areas), watersheds (for domestic use, etc), areas inside city limits, research facilities, research study exclosures, special-use sites, and critical habitat for T&E species

Closed lands have been examined across the Forest using the RMRIS database and input from the Ranger Districts Both capable and non-capable lands can be "Closed to Livestock Grazing " Many areas across the Forest have been closed to grazing for biological reasons, on either a temporary or permanent basis These lands include regeneration sites for timber, riparian areas, developed springs, fens and bogs, and other sites Generally, these types of closed sites are fenced to exclude livestock grazing until conditions of a temporary closure have been fulfilled or they are permanently closed for long term site needs Areas closed to grazing are considered lands of foregone uses, relative to livestock grazing Queries and data requests have been made of the Districts for lands closed by

* Forest line officer,
* Forest Plan,
* Executive Order,
* Acts of Congress,
* Order of the Secretary of Agriculture,
* Lands under roads (Forest transportation system), or
* Other

"Suitable" lands for livestock grazing have been identified across the Forest as those lands capable of supporting grazing on a sustained basis The total acreage of these lands is shown in Table 3-45

Economic Suitability

The RGNF desires to have a managed livestock-grazing program, in which cost efficiencies are among the factors taken into consideration when deciding between range management Prescriptions or Alternatives (CFR 219 20 (b)) Economic analyses were undertaken from two perspectives The first considers a taxpayer perspective, including only revenues from grazing fees and agency expenses in managing the livestock-grazing program This is referred to as a "financial efficiency" analysis The second considers the full market value of grazing under permit as benefits and the same agency expenses as costs This is referred to as a "cost efficiency" analysis

The first analysis uses the 1996 grazing fee rate established by Congressional formula of $1 61 per AUM for revenues The second analysis uses the updated RPA market-clearing value of $12 40 per AUM for benefits

The RPA fair market value of grazing is an approximation of what permittees would be willing to pay if grazing permits were auctioned In practice, this value would be different for each allotment This value takes into account specific allotment characteristics, herd characteristics, the operational efficiency of the permittee, and market forces. These include the construction and maintenance of range improvements, trucking livestock between the base ranch and the allotment, hauling water where necessary, energy costs (electricity for pumping water, gasoline, etc), herding, and monitoring livestock use

Agency costs include permit administration, planning, and range improvements

The "no action" baseline in Forest planning is the continuation of current management For this reason, the financial and economic-efficiency analyses were completed using current management as the baseline for comparison with other prescriptions and/or alternatives Financial efficiency and cost efficiency are expressed in terms of present net value (PNV) on

a per acre basis Revenues, benefits, and costs are discounted over 50 years at a 4% discount rate The results are shown in Table 3-45.

Table 3 - 45. Summary of Economic Analysis for Livestock Grazing Suitability

Summary of Economic Analysis for Livestock Grazing Suitability			
Range Prescription Measure	Current Mgt	Alt G	Alt F
Suitable Acres	617,106	576,996	556,329
Annual Average over 50 yrs			
AUMs per acre	14	14	07
Acres per AUM	7 38	6 97	14 98
Revenues per AUM	$1 61	$1 61	$1 61
Revenues per acre	$0 22	$0 23	$0 11
Benefits per AUM	$12 40	$12 40	$12 40
Benefits per acre	$1 68	$1 78	$ 82
Costs per acre	$0 72	$0 88	$0 61
Net revenues per acre	($0 50)	($0 65)	($0 50)
Net benefits per acre	$0 96	$0 90	$0 21
Financial Efficiency per acre			
Present Value of Revenues	$4 26	$4 55	$2 14
Present Value of Costs	$15 37	$18 97	$13 11
Present Net Value	($11 11)	($14 42)	($10 97)
Economic Efficiency per acre			
Present Value of Benefits	$27 71	$29 73	$13 92
Present Value of Costs	$15 37	$18 97	$13 11
Present Net Value	$12 34	$10 76	$00 81

Livestock and Wildlife Forage

"Rangelands" are defined as all lands producing, or capable of producing, native forage for grazing and browsing animals, and lands that have been revegetated naturally or artificially to provide a forage cover that is managed like native vegetation They include all grasslands, forb lands, and shrublands, and those forested lands that can, continually or periodically, naturally or through management, support an understory of herbaceous or shrubby vegetation that is forage for grazing or browsing animals

Livestock producers, as well as outfitters, guides, and visitors, depend on range forage for their stock and recreation opportunities These same lands offer forage and habitat for a variety of wildlife species.

The livestock industry began in the southern portion of the San Luis Valley in the late 1700s Livestock was brought from northern New Mexico to summer on the valley floor The first livestock to graze any of the area that is now the RGNF were brought into Raton Park in 1856

Control of livestock grazing began about the time the Forest Reserve was established The first adequate records of livestock for the RGNF date from 1910 (Figure 3-57)

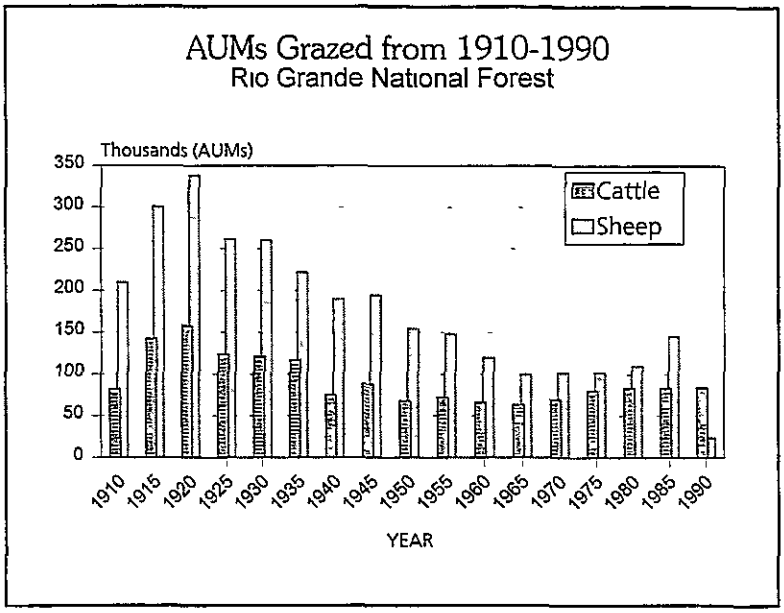


Figure 3-57. AUMs Grazed from 1910-1990

Since then, livestock numbers and seasons of use have decreased to the numbers and time permitted today The highest numbers of AUMs on the Forest (roughly 500,000) occurred in 1920, and AUMs have since decreased to 81,937 (1995)

The decrease in numbers is due in part to bringing livestock numbers and management into compliance with estimated capacities, and also to changes in agriculture operations within the valley While sheep production was a major emphasis in the early years, it now plays a less significant role in livestock AUMs grazed on the Forest Poor prices for lamb and wool, and difficulty in obtaining herders, have caused many sheep raisers to shift to cattle or divest themselves of livestock altogether

The use of the La Garita Stock Driveway (a designated route to summer range) is an example of this shift in the sheep industry At one time it was estimated that about 100,000 head of sheep were trailed to and from summer range via this route Today, only about 2,000 ewes with lambs travel a portion of this driveway to and from the range There are other bands of sheep seen along the driveway, where it is within a grazing allotment, but they no longer use the driveway as a major access route to and from the allotment

AFFECTED ENVIRONMENT

Rangelands on the RGNF are naturally fragmented, because of highly dissected mountain slopes and changes in vegetation as elevation increases They can be characterized by narrow canyons with a riparian ecosystem, and adjacent grassland communities

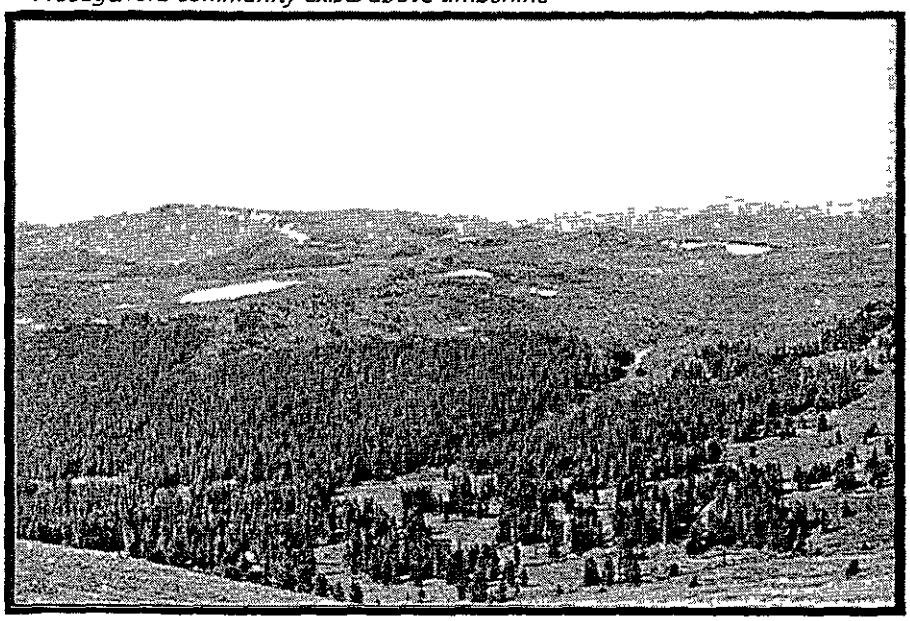
intermingled with timberlands in the montane and subalpine zones Lower elevations are a mixture of blue grama, western wheatgrass, pinon-juniper, and some ponderosa pine areas

Current range conditions are largely a reflection of past grazing practices. Thousands of sheep and cattle wintered on lower-elevation ranges, then, beginning in April and May, cattle grazed these same areas The result was that many of these ranges have changed in plant composition and density, with some areas having had both sheet and gully erosion These low-elevation areas take longer to recover because they are the most impacted by grazing, and the low yearly precipitation does not provide a good plant/soil moisture relationship These areas are recovering, however, because livestock numbers have been reduced and improved management initiated

As elevation increases, the vegetation consists of aspen and spruce/fir forests with interspersed grassland meadows

Under present management, roughly 531,000,000 pounds of forage are produced on suitable rangelands per year About 137,000,000 pounds are needed per year to support current levels of livestock and big game on the Forest This leaves 394,000,000 pounds of forage for plant health, vigor, regrowth, wildlife habitat, and soil and water needs These calculations are estimates, as they are dependent on such variables as weather, use patterns, and different species' competition for forage

A sedge/forb community exists above timberline



While about 81,940 AUMs of livestock use are permitted on the Forest each year, actual AUMs are usually less because of economic or drought conditions The Colorado Division of Wildlife estimates that

about 70,480 wildlife AUMs are grazed on the Forest each year Wildlife do not use the Forest exclusively; they also graze adjoining private or other public lands

There appears to be adequate forage production for current livestock and wildlife numbers, however, some problems do exist There continue to be rangeland areas in unsatisfactory condition the range analysis data indicate roughly 185,080 acres This amounts to approximately 82% of the suitable rangelands on the Forest The acreage of unsatisfactory rangelands are only estimates based on past range analysis that has not been updated on some allotments for many years We expect that the acreage is less than stated, because of the improved management and reduced livestock numbers during this time frame

There are also conflicts between elk and livestock for spring and summer forage, on some portions of the Forest Elk will sometimes graze riparian areas heavily before livestock are placed on the grazing allotment Allowable-use levels can, therefore, be exceeded before livestock are grazed This problem is compounded when there is a late spring and slow snowmelt, or during drouth situations because of slow plant growth

Based on the winter-range study, a large portion of the winter-range areas is in unsatisfactory range condition This is due to uncontrolled livestock numbers and use from 1870 to 1920 In addition, some isolated areas have received heavy browsing by wildlife on shrub species, such as winterfat and mountain mahogany

Two other areas that have been impacted in the past by uncontrolled livestock grazing are riparian areas and the ponderosa pine landtype association Improper grazing has, in some cases, changed plant composition, reduced productive capability of vegetation, affected stream bank stability, and degraded wildlife habitat Improved management, such as deferred or rest-rotation grazing and less livestock use of the areas, has been initiated Such items as special riparian pastures may need to be developed within some allotments, however, to enhance resource improvement. Ponderosa pine may need a combination of activities (i e , thinning, fire, and improved livestock management) to enhance this ecosystem

Suitable, capable, and non-capable lands for grazing have been determined for the Forest (see Appendix and maps) It is proposed to close some allotments or portions of them to grazing, by allocating these areas to Research Natural Areas It is also proposed to close eight vacant allotments to grazing, because of resource conflicts The following allotments are proposed to be closed to grazing

*	Natural Arch	Conflict between domestic and bighorn sheep, poor range conditions
*	Red Mountain	Unstable creek, access for livestock is denied across private land, limited management opportunities exist for control of livestock.
*	Goose Creek	Inaccessibility through private land, summer elk range, narrow canyon limits management opportunities
*	Alto Rito/Crestone	Domestic and bighorn sheep conflicts, recreational conflicts

*	Cottonwd/Cherry	Recreational conflicts, steep terrain, possible domestic/bighorn sheep conflicts
*	Dimmick	Vacant allotment, livestock/recreation conflict, portion of allotment is proposed for RNA designation
*	Sand Creek	Access through private land is a problem, livestock/recreation conflicts
*	Medano	Riparian management, Rio Grande cutthroat trout habitat, access for livestock is only through east side of the allotment, livestock/recreation conflicts

These areas will not be considered part of the suitable land base for grazing Table 3-46 displays the suitable, satisfactory condition, and unsatisfactory condition acreage by alternative

Table 3-46. Range Suitability by Category

Range Suitability by Category							
Category	**Alt A**	**Alt B**	**Alt D**	**Alt E**	**Alt F**	**Alt G**	**Alt NA**
Uncapable	1,335617	1,335,617	1,335,617	1,335,617	1,335,617	1,335,617	1,335,617
Capable	625,437	625,437	625,437	625,437	625,437	625,437	625,437
Satisfactory	190,516	198,382	190,516	190,516	190,516	208,051	238,779
Unsatisfactory	181,946	190,480	181,946	181,946	181,946	185,078	194,460
26-40% Slope	183,867	183,867	183,867	183,867	183,867	183,867	183,867
Total Suitable Acres	556,329	572,729	556,329	556,329	556,329	576,996	617,106

Satisfactory and unsatisfactory-condition acres were used to calculate carrying capacity by alternative These are summarized by alternative for the first and fifth decades is in Table 3-47 below

The following figures show the suitable grazing land by Alternative

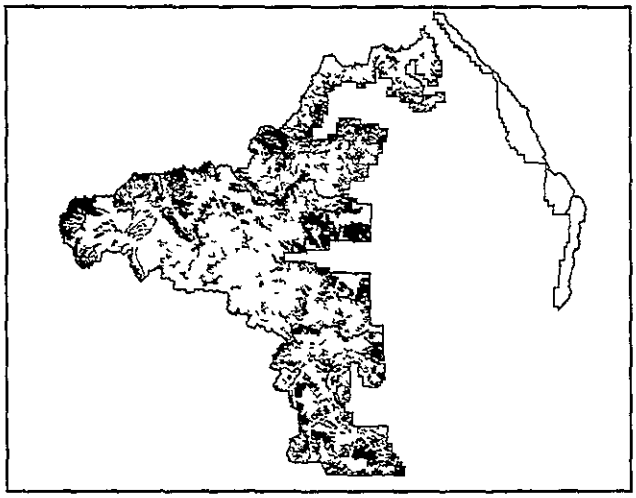


Figure 3-58 Suitable Rangelands, Alternative A

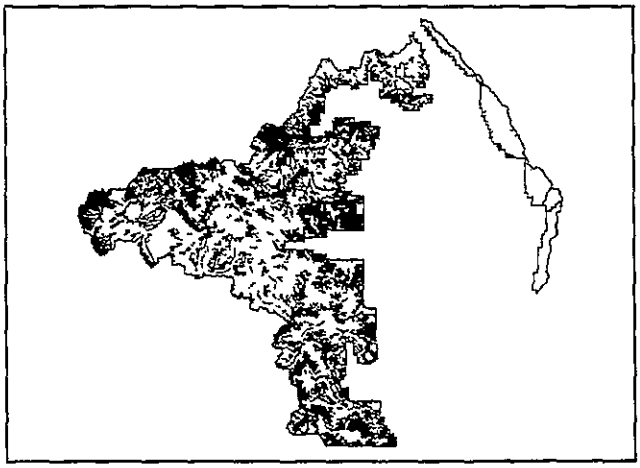


Figure 3-59 Suitable Rangelands, Alternative B

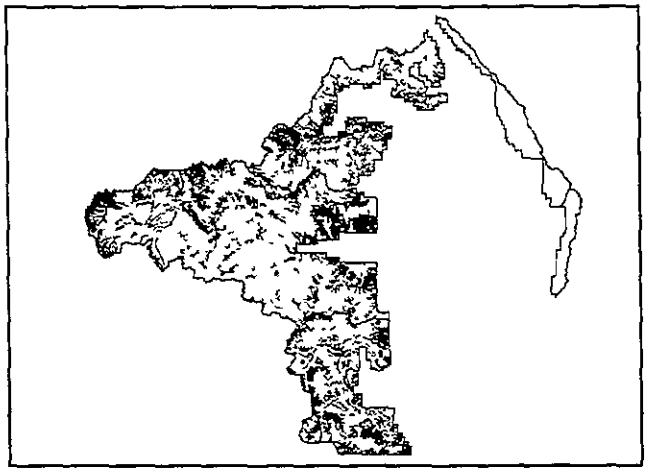


Figure 3-60. Suitable Rangelands, Alternative D

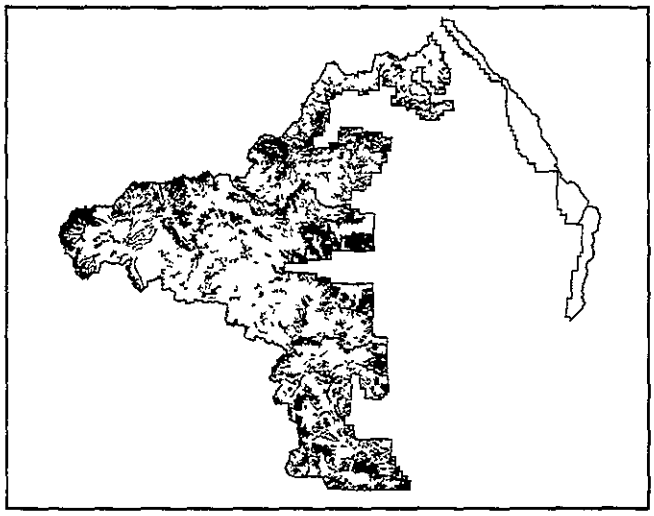


Figure 3-61. Suitable Rangelands, Alternative E

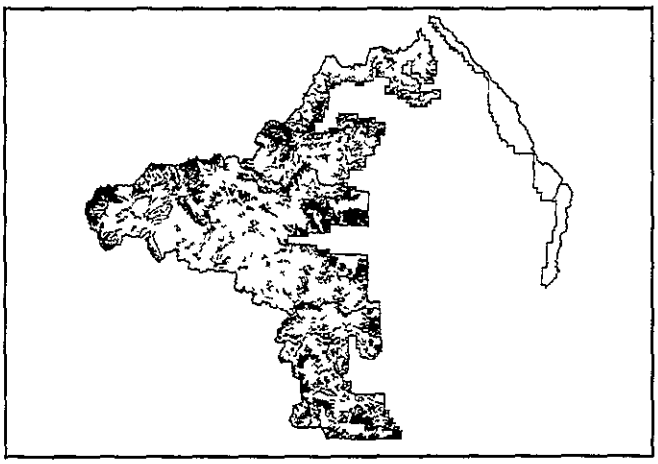


Figure 3-62 Suitable Rangelands, Alternative F

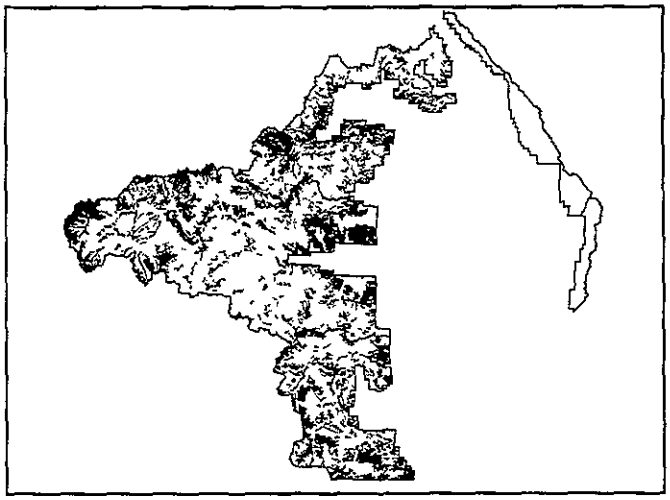


Figure 3-63 Suitable Rangelands, Alternative G

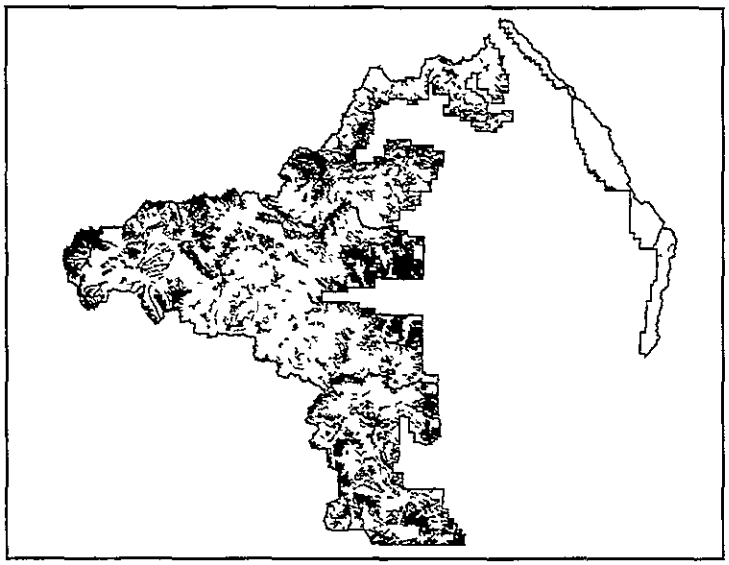


Figure 3-64 Suitable Rangelands, Alternative NA

We do not anticipate that livestock levels will increase in any alternative before the fifth decade Also, we do not expect that wildlife numbers will increase to any great extent, except that the long-term goals for deer numbers are higher than at present

Table 3-47. Head Months of Grazing by Livestock and Wildlife

	ALTERNATIVE						
	A	B	D	E	F	G	NA
Decade 1	127,778	224,136	176,392	138,891	107,613	158,501	259,508
Decade 5	127,778	246,550	185,212	138,891	107,613	166,426	259,508

Range of Natural Variability Conclusions

* Early journals and records give a very incomplete description of nonforested ecosystems' composition, structure, and function

* The fire frequency was probably higher at lower elevations and lower at higher elevations, based on suspected fire frequencies in forested ecosystems

* Fire suppression has been most effective this century in the lower elevations Consequently, changes in the natural fire regime are probably more significant at the lower elevations on the Forest The Forest is probably experiencing a longer fire-frequency interval in low elevation ecosystems, but not in high elevation ones

* Livestock grazing is a dominant, new phenomenon influencing nonforested communities post-settlement.

* There is general evidence that nonforested communities have probably been altered (in their species composition) because of repeated, frequent domestic livestock grazing This evidence is an inference from the estimated overall ecological condition of the nonforested communities This was determined by using diagnostic plant species as indicators of ecological change and the vegetation composition typically seen in these communities across the Forest

* We have no evidence that pre-settlement grazing was as high or as frequent as domestic livestock grazing around the turn of the century Also, there is no evidence that it was repeated annually or covered as much of the nonforested landscape

* If the number and extent of introduced species are any indication, riparian areas probably underwent the greatest change compositionally Less alteration has probably occurred in the upland nonforested communities, but it is doubtful the extent of acreage in mid-seral and lower ecological condition existed prior to settlement

* The nonforested communities of the Forest, collectively, have probably been altered (in their species composition) since settlement more than they were over the several centuries before settlement

RESOURCE PROTECTION MEASURES

In light of the information we have about acres of rangelands in unsatisfactory condition, and conclusions about the range of natural variability, we need to implement measures to enhance recovery of the rangeland resource Forest Plan Standards and Guidelines have been designed to maintain and improve conditions Allowable-use levels for forage by livestock and wild herbivores have been set as Forestwide Guidelines for key areas Consideration has been given to areas both in satisfactory and unsatisfactory condition

These Guidelines have been developed from information in the following reference materials These guidelines will allow plants to meet their physiological needs for growth and reproduction, on rangelands in both satisfactory and unsatisfactory condition Since proper grazing depends on the type of vegetation present, landform, range condition, soil concerns, water quality needs, season, intensity of grazing, and other considerations, utilization can also be specified on a site-specific basis If actual utilization levels exceed the allowable-use levels, as described either in the Forest Plan or in the Allotment Management Plan, livestock will be removed from the pasture or allotment

Riparian management is of utmost concern on the Forest These areas are sensitive to such uses as grazing, logging, recreation, and road construction Intermountain Research Station General Technical Report INT-263 *Managing Grazing of Riparian Areas in the Intermountain Region*, by Warren Clary and Bert Webster, has been adopted by the Forest for management of riparian areas In addition, other guidelines and "Best Management Practices" from soil and water resources will be used to maintain or restore these areas to functional ecosystems Development and implementation of a site-specific Environmental Assessment and Allotment Management Plan will provide a more in-depth action plan to

protect this resource (A schedule for revising allotment management plans is on file at the Forest Supervisor's Office at Monte Vista, Colorado)

In addition to the above measures, the Forest is proposing to close eight allotments to grazing This proposal is based on a variety of needs and reasons poor watershed conditions, conflicts with other uses, and lack of demand for some of them The closure of these allotments will allow these areas complete rest from livestock grazing

The Standard to phase out continuous season-long use, unless it is needed to attain a specific vegetative condition, will allow plants to meet their physiological needs for growth and reproduction The implementation of grazing systems that include rest or growing-season deferment and proper utilization levels will enhance vegetative composition, and ultimately the ecological condition of riparian and upland sites

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Effects on Rangelands from Recreation Management

We expect dispersed recreation to increase in all alternatives More interaction between recreationists and livestock will cause more conflicts

Some public-land users do not want livestock on the Forest. Their concerns range from the potential for overgrazing, to the risk of a non-native animal displacing native species, to being offended by livestock manure

Vandalism of range improvements could grow because of increased visitor use This would increase operating costs to both the permittee and the public, in order to maintain improvements for proper livestock management Alternatives A, D, E, F, and G would increase acreage devoted to dispersed recreation, and have the potential to reduce livestock use

Effects on Rangelands from Areas Recommended for Wilderness

Livestock grazing is an allowable use in designated Wilderness, as provided in the *Wilderness Act of 1964* This use conflicts with the values of individuals who want a livestock-free Wilderness experience

Management of the Wilderness resource, while not excluding livestock, will emphasize a "lighter touch" on the land This has the potential over time to reduce permitted-livestock numbers

Alternatives A, E, and F will recommend areas for inclusion in the National Wilderness Preservation System This could reduce livestock numbers, as these areas would be managed with a lighter touch

Effects on Rangelands from Research Natural Areas

RNA designation would prohibit livestock grazing in five of the RNAs, in the other, grazing would be by exception The RNAs are in vacant allotments or within an area of an allotment that is not normally grazed by livestock The absence of livestock grazing would allow these areas to function ecologically without the present influence of livestock grazing

Permitted-livestock numbers would not be reduced or increased by the designation of these areas as Research Natural Areas This designation does, however, reduce the opportunity to improve management on other allotments by using these areas in combination with them

Effects on Rangelands from Wild and Scenic Rivers Management

Livestock grazing is allowed in designated Wild and Scenic Rivers areas Livestock must be managed so that these areas have a natural appearance, however If this is not achievable, riparian pastures and adjacent uplands may not be available for grazing This could reduce livestock grazing or increase costs, by requiring the construction of additional range improvements to control use within riparian areas and on adjacent uplands.

Effects on Rangelands from Wildlife Habitat Management

While fish and wildlife management objectives are generally compatible with range management objectives, there is the potential for conflict

The capacity estimates for the rangeland resource were calculated for total demand by domestic and wild ungulates Alternatives A, E, and F do not allocate sufficient forage to satisfy both wildlife and domestic-stock demand Livestock numbers could be reduced by these alternatives

Other habitat requirements—winter range, calving or fawning areas, residual cover, undisturbed cover for nesting—could affect livestock management and/or numbers These cases would be determined at the project level, and appropriate mitigation measures would be applied to meet site-specific requirements

Effects on Rangelands from Threatened, Endangered, and Sensitive Species Management

The Forest has both animal and plant species on the Threatened, Endangered, and Sensitive (TES) species lists (Appendices E, F, and G) Some of these species may restrict grazing to particular seasons, limit the level of use, or possibly increase the cost of management in order to restore, maintain, or enhance habitats in the recovery of TES species Range management objectives will be formulated to protect or enhance TES species.

Effects on Rangelands from Riparian and Wetland Management

All the alternatives emphasize management and protection of riparian areas and wetlands Intermountain Research Station General Technical Report INT-263, *Managing Grazing of Riparian Areas in the Intermountain Region*, by Warren Clary and Bert Webster (1989), will serve as a guideline to protect, maintain, and enhance riparian areas within the Forest

Management will apply combinations of stubble height requirements, streambank stability, vegetative seral stage, and rest to determine management actions necessary to restore riparian area condition These actions will maintain, improve, or restore riparian-wetland functions, including energy dissipation, sediment capture, groundwater recharge, and stream bank stability

Implementation of this guideline may require changes in management and additional range improvements This could increase the cost of management to the public and to the permittee

Effects on Rangelands from Soil, Water, and Air Quality Management

Under all alternatives, proper livestock use will improve soil and water conditions on unsatisfactory-condition rangelands, through application of Forest Plan Standard and Guidelines The allowable-use Guidelines will maintain or promote adequate amounts of vegetation ground cover, including standing plant material and litter, to support infiltration, maintain soil moisture storage, and stabilize soils They will also maintain or promote subsurface soil conditions that support permeability rates appropriate for the climate and soils

Only Alternatives B and D are expected to have an increase in AUMs, as a result of improved rangeland condition, but this is not expected to occur until the fifth decade

Effects on Rangelands from Roads

Roads are not considered suitable grazing lands, thus they are not included in grazing-capacity calculations Restricted use of some roads would occur in every alternative, but there is little potential for new road construction in Alternatives A and F This restricted use should not affect maintenance of range improvements, as permission can be given to permittees to use these roads in order to maintain range improvements, so long as they do not violate the conditions and terms of the Term Grazing Permit

Effects on Rangelands from Heritage Resources Management

Heritage resource management would have similar effects on rangelands under all alternatives All high-probability sites will be inventoried and mitigation measures implemented so that heritage resources are not affected Management and development costs could increase

Effects on Rangelands from Pest Management

Under all alternatives, the Forest Plan Standards and Guidelines and objectives have been developed to enhance native vegetation Rangeland management emphasizes native species by promoting the opportunity for seedling establishment of appropriate plant species

Effects on Rangelands from Fire Management

In the short term, wildfire can affect livestock use either positively or negatively It can increase forage, by removing competition from brush and trees This forage should be considered temporary, though, and capacity should not be based on it

It may be necessary to remove livestock in order to allow the rangeland resource to recover Some range improvements may be destroyed, thus affecting management Both of these scenarios will cost the permittee, by requiring the renting or leasing of pasture or the reconstructing of improvements The cost to the public would be from replacing improvements, and the potential loss of grazing revenues

Effects on Rangeland from Timber Management

As timber is harvested, it may open areas to livestock grazing that were not available before The reduced canopy allows space and light for increased grass and forb production, and/or the area is no longer a barrier to livestock movement, because of road construction and reduction of timber as a barrier

Increases in forage availability due to timber harvest will not increase livestock numbers Thus forage is temporary, in that these sites will eventually return to timber-dominated stands Management costs may increase, because fences may need to be constructed to control livestock movement

Alternatives A and F would have little effect on providing additional transitory rangelands Alternatives B, D, E, G, and NA would produce more forage

Cumulative Effects

Grazing strategies are designed to allow the rangeland resource to evolve to satisfactory condition The time period to begin this recovery on individual allotments would be spread over 15 years This could delay improvement on individual allotments until Environmental Assessments and Allotment Management Plans are developed and implemented

Management options to correct unsatisfactory rangeland condition or to improve management could be reduced by administratively closing areas to livestock grazing (i e , Research Natural Areas and designated vacant allotments)

RIPARIAN AREAS

ABSTRACT

It is difficult to discuss riparian areas (water bodies and adjacent plant communities) without including the water sources they depend on For this reason, this section is similar to the Aquatic Resources section

Riparian areas comprise about 129,400 acres, or 7% of the RGNF. Most of these areas are included in an inventory showing their location and size Riparian areas are typically long, narrow stringers of land They cannot be displayed effectively on a Forestwide map, but are available on the Forest's Geographical Information System (GIS)

Riparian areas are a valuable component of the Forest ecosystem They are critical habitat for a large variety of animals, and also are an important link between streams and upland sites, providing shade, bank stability, and filtration of pollution sources Readily available water allows fairly rapid vegetative responses to changes in management

Management practices to protect these areas are included in this Plan Condition is measured as part of stream-health and range-allotment assessments The Forest goal is to keep these areas in good to high ecological condition, unless management for lower condition is needed (for example, to protect a Threatened or Endangered species that requires lower-condition habitat) If unacceptable conditions are encountered, management is altered to ensure recovery Reference streams have been selected for evaluating riparian-area conditions

The various alternatives allow different levels of activity and associated disturbance In those that allow more resource use, the potential risk of riparian-area impacts is increased, but does not make any alternative unacceptable All activities are addressed with appropriate mitigation to prevent degradation of natural functions and associated values Mitigation includes properly locating facilities that concentrate use, and redirecting activities that exceed site resiliency

INTRODUCTION

Legal Framework

The Organic Administration Act of 1897 recognized watersheds as systems that have to be managed with care, to sustain their hydrologic function

The intent of the *Clean Water Act* (actually a series of Acts from 1948 - 1987) is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters Required are (1) control of nonpoint-source water pollution by using conservation or "best

management practices," (2) government agency leadership in controlling nonpoint pollution from federally managed lands, and (3) rigorous criteria for controlling discharge of pollutants into the waters of the United States

One purpose of the *National Forest Management Act of 1976* is to prevent watershed condition from being irreversibly damaged, by protecting streams and wetlands from detrimental impacts Land productivity must be preserved Fish habitat must support viable populations that are well distributed throughout the planning area

The Endangered Species Act requires federal agencies to conserve Threatened and Endangered species and the ecosystems they depend on.

Executive Order 11988 of May 24, 1977, requires that each agency demonstrate leadership and take action to minimize impacts associated with occupancy and modification of floodplains, reduce risks of flood loss, minimize the impact of floods on human safety, health, and welfare, and restore and preserve natural and beneficial values served by floodplains

In support of these laws, regulations have been passed that require productivity from all natural-resource management activities and protection of surface resources (CFR 219), as well as preferential consideration of riparian-dependent resources when conflicts occur between land-use activities (FSM 2500)

The Forest Service's Rocky Mountain Regional Office, in Golden, Colorado, has developed a *Water Conservation Practices Handbook.* It contains direction that applies to all ground-disturbing activities in the Rocky Mountain Region From that Handbook, Standards and Design Criteria to protect riparian health during project implementation have been incorporated into this Plan.

The Value of Riparian Areas

Riparian areas, which consist of water bodies and adjacent plant communities, are a unique land type on the Forest. Streams and lakes supply water to plants for a short distance from the water body Plants in a riparian area, like willows and sedges, depend on the water source This distinct water-loving vegetation makes most riparian areas easy to recognize.

Riparian areas are home to a greater variety of aquatic and terrestrial wildlife than any other habitat type They are crucial for maintaining biotic diversity and proper function of the larger landscape (Gregory, et al., 1991) Their importance is highlighted by the fact that they make up only about 7%of the RGNF land area

Use of riparian areas is highly competitive They are important to wild animals, domestic grazing, recreation, and timber production Competitive uses of riparian areas draw wide interest and must be resolved through proper balancing of protective measures and controlled use of resources

Inappropriate use of these areas includes poorly designed road crossings, unrestrained off-road-vehicle use, livestock trailing, large gold-dredging operations that significantly alter stream banks, and timber slash accumulation Such uses can reduce the size and vigor of riparian areas

Fish

Good fish habitat depends on healthy riparian areas Sediment is captured by riparian vegetation during high flows Banks build by sediment accumulation, causing stream channels to narrow and deepen Deep, narrow stream channels with overhanging banks offer ample food, shade, cover, and overwintering pools for fish

Riparian vegetation is important for trapping large organic matter This is beneficial to aquatic biota that need such matter for food and living space (Speaker, et al , 1988)

Floodplains

Healthy riparian areas depend on healthy stream channels, with their associated floodplains A floodplain with vigorous, deep-rooted riparian plants can withstand the forces of most floods

AFFECTED ENVIRONMENT

Riparian Area Condition

The Forest has an inventory showing the location and extent of riparian areas 160 feet wide and larger Riparian areas less than 160 feet in width were estimated by stream order

Based on this inventory, there are about 129,400 acres of riparian area, associated with 11,160 miles of stream and other wetland areas Riparian area condition evaluations occur as part of project Environmental Assessments A Forest riparian-plant classification was initiated in 1995, and a current vegetation-composition inventory is scheduled to begin in 1997 The completion of these two additional pieces of information will allow a Forestwide assessment of riparian condition

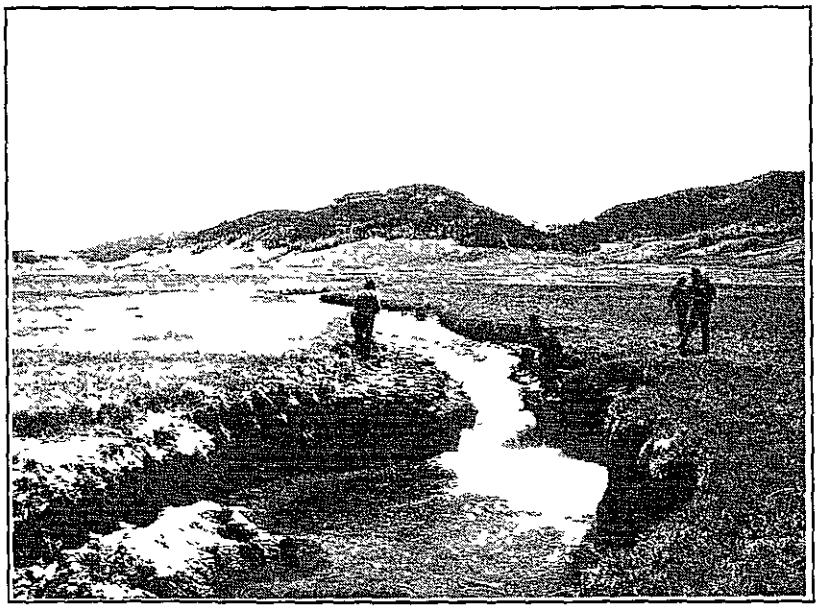


Figure 3-65. Headcut on Kitty Creek prior to Restoration

Range specialists have estimated over the last ten years that 51% of riparian areas within grazing allotments were meeting existing Forest Plan Objectives, 16% were moving toward Forest Plan Objectives, 9% were not meeting or approaching Objectives, and 24 % were in an undetermined status. They estimated that 9 % of the riparian areas within grazing allotments needed additional work to progress in the right direction Much has been accomplished since then, so the original 9% estimate is high Major restoration work has occurred in two riparian areas. Crooked Creek, near Creede, had about one-half mile of reconstruction to heal a gully Kitty Creek, also near Creede, had a head cut control structure installed in the early 90s to stop the advancement of a gully into prime trout habitat and an exclosure installed to control livestock use Although the availability of Forestwide condition data would help us manage the land more knowledgeably, the lack of it does not prevent routine application of proven methods of riparian protection

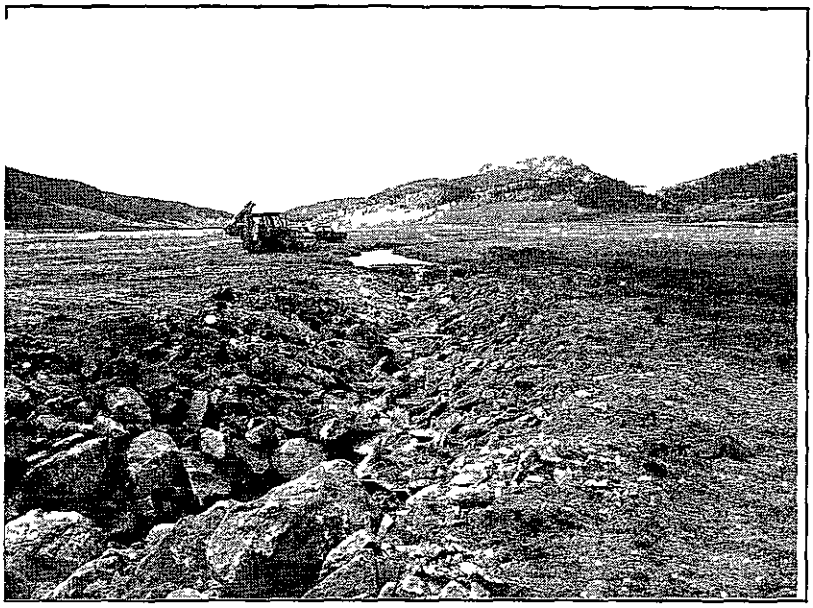


Figure 3-66 Kitty Creek after Restoration

Conservation practices that protect riparian areas are being incorporated in range use permits, road construction stipulations, and plans for timber harvest, mining, and recreation use Stream-health surveys, described in the Resource Protection section, will help identify stream and associated riparian area problems, by comparing them with reference sites

Timber Harvest

Timber harvest activities affected some Forest riparian areas in the past, before current management practices were followed Harvesting and skidding of logs in riparian areas have caused isolated problems Specific problem areas are scheduled for restoration as they are discovered through our Watershed Improvement Needs (WIN) inventory The WIN inventory and restoration work are ongoing, some watershed restoration work is accomplished almost every year

Roads

Many existing roads were built close to streams, and some have affected riparian areas Compliance with current Forest Plan Standards and Guidelines and with the new *Watershed Conservation Practices Handbook* will prevent this in the future

Bringing problems created in the past into compliance with new protection measures is a big challenge Relocating roads is very expensive People who have become accustomed to using roads do not want to see them closed Reassessing the road network and identifying restoration needs have become a routine part of project planning

Grazing

Grazing by large animals is one of the main sources of stream bank damage on the Forest Cattle and elk are the main culprits Livestock grazing affects the riparian environment by changing and reducing vegetation, or by actually eliminating riparian areas by channel widening, channel aggradation, or lowering of the water table (Armour, et al , 1990) Elk move more than cattle, so effects from elk are likely to be concentrated in different spots at different times Cattle mostly use low-elevation pastures These narrow riparian pastures are a special management challenge, because cattle naturally stay too long in the riparian area Limits on the use of riparian vegetation and on the amount of stream bank trampling dictate when cows must leave riparian areas

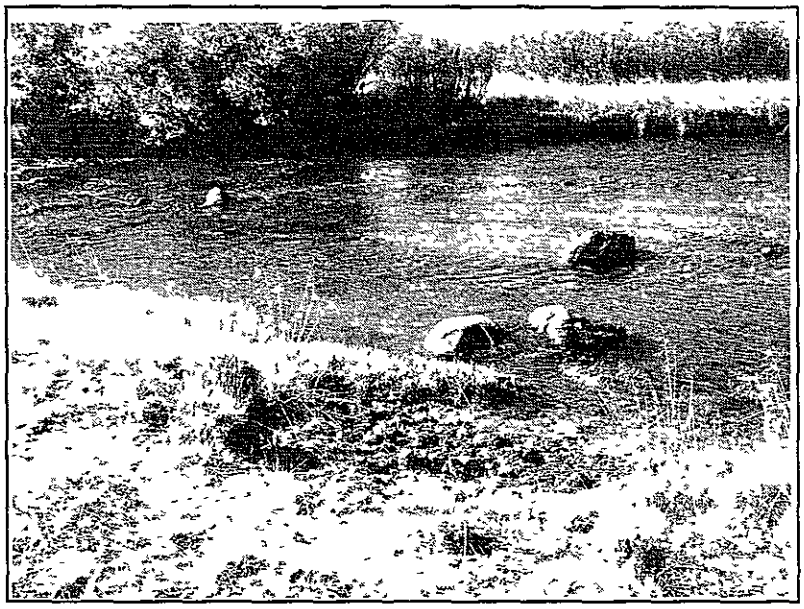


Figure 3-67 Bank Damage on North Clear Creek

On some sites, long-term use has changed the vegetation composition Shallow-rooted, less vigorous plants have made these sites more susceptible to natural erosive forces

A complete inventory of grazing effects is not available Problems are dealt with as they are discovered through normal monitoring If changes in management are needed, they are made through annual operating plans and range permit reissuance Range use permits include conservation practices designed to protect riparian areas

Mining

In the past, mining often occurred in and near streams, sometimes damaging riparian areas Initially, the potential effects of putting mine waste in stream channels were not understood Later, it became apparent that mine tailings were contaminating water and killing riparian vegetation, but the technology to prevent damage was not available—or not valued above the resources being extracted

Kerber, Willow, and Alamosa Creeks have riparian areas that have been eliminated in sections as a result of past mining A good deal of restoration work has occurred in all these drainages

There has been about 40 acres of disturbance over the past ten years associated with locatable-mineral exploration and development Appropriate mitigation has been applied to protect riparian areas

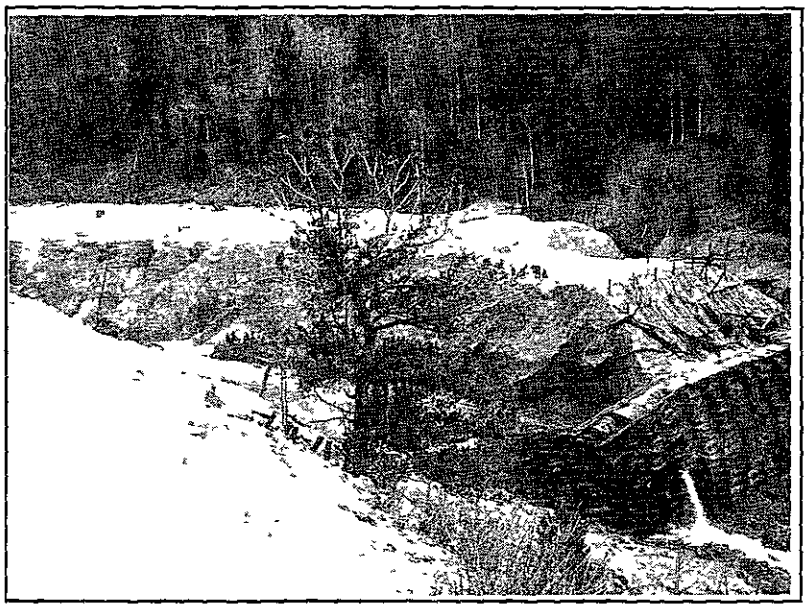


Figure 3-68. Tailings Piles on Forest - Bonanza Mining District

Recreation

Recreation has affected some riparian areas Impacts have included loss of vegetation from concentrated camping and horse use Problems are dealt with as they are encountered This occurs by closing access to areas or by educating the public on how to use the land with a light touch (as in the "Tread Lightly" and "Leave No Trace" programs)

Riparian areas are desirable places to both animals and humans Many developed campgrounds have been built in riparian areas Also, in some dispersed-camping locations, the terrain has forced people to use streamside campsites When no buffer exists between the campsite and the stream or lakeshore, impacts can occur In these areas, camping next to streams has been discouraged, and overnight camping restricted, to allow for site recovery and prevent further damage Stream impacts from dispersed camping appear to be rare on the Forest, however

Oil and Gas

Oil and gas leasing has no impact on surface resources Exploration has had minor surface impacts associated with drill pads and access roads Since 1982, five holes have been drilled, but impacts were thoroughly mitigated

Range of Natural Variability Conclusions

They are the same as those described in the Aquatic Resources section

Resource Protection Measures

Riparian areas can retain a healthy balance with some resource use and disturbance The RGNF intends to manage disturbances so that healthy riparian areas function properly and contribute needed habitat

Management will provide protection.

* by including riparian areas in watershed assessments of risk resulting from past, present, and foreseeable future impacts, and from the presence of sensitive areas;

  Disturbances of riparian areas have been identified and recorded as part of a watershed-by-watershed assessment The watershed assessment uses a sensitivity level that emphasizes riparian areas by quantifying the watershed area within 100 feet of stream channels If over 50 % of a watershed area lies within 100 feet of a channel, the watershed is considered sensitive to disturbance This distance from stream channels includes riparian areas, so the more riparian area within a watershed, the more that watershed is considered to be sensitive to disturbance

  Limiting disturbance in Watersheds of Concern until impacts on riparian areas are verified, restoring problem areas, and requiring extra mitigation when riparian areas have been impaired will help ensure that protection required by the laws described in the Legal Framework section is implemented

* by using conservation practices (BMPs) to minimize the impacts of land disturbances;

  Standards and Guidelines proven to be effective in protecting riparian areas have been incorporated into the Final Revised Forest Plan

* by isolating most disturbances away from riparian areas, and

* by using reference streams as benchmarks to ensure that riparian areas achieve and maintain robust health

  New concentrated-use sites will be situated away from riparian areas When new watershed disturbances are proposed, stream-health and associated riparian area data will be collected, and compared to reference-stream data If riparian areas have been impaired, restoration work will be identified and additional mitigation required, to prevent further degradation

  Limiting impacts so that riparian areas are at or trending toward reference riparian conditions will ensure that proper functioning conditions are available for future users

Riparian Condition Assessments

The Forest Service has adopted a technique for assessing riparian area condition that was initially developed by the Bureau of Land Management It is called *A Process for Assessing Proper Functioning Condition* With this approach, Forest project teams will characterize riparian condition by whether sites are functioning properly and, if not, what the condition trends are This information will be available to decision-makers to alter management, if necessary, to produce trends toward proper function

DIRECT AND INDIRECT EFFECTS

Natural processes, functions, and values of riparian areas are thoroughly described in many textbooks and research articles (e g , Gregory et al , 1991) This EIS will not reiterate most of that information The effects described below will be only those that stem from how the land is managed and used

Effects on Riparian Areas from Timber Harvest

Trees can be harvested within riparian areas, if riparian-area functions and values are protected Riparian areas are not part of the suitable timber base in any alternative, so the Forest does not need to harvest trees from them to contribute to the allowable sale quantity (ASQ)

Figure 3-69. Good Skid Trail Location

Timber harvest itself is not a serious source of disturbance of riparian areas Disturbances associated with normal timber harvest operations, including roads, skid trails, and landings, cause most concerns

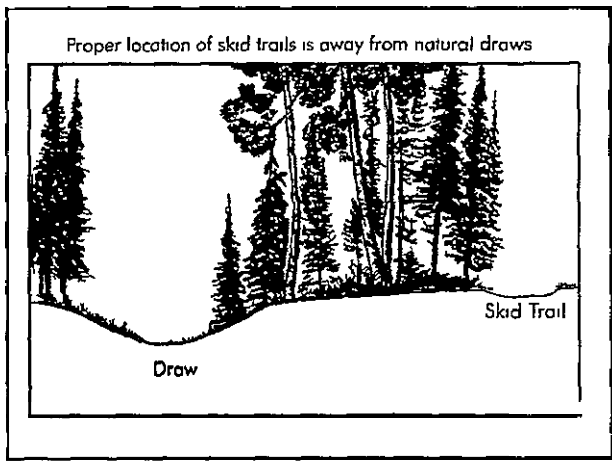


Figure 3-70 Skid Trail Layout

If heavy equipment is used in riparian areas, harvest activities can leave exposed and compacted surfaces that disrupt water infiltration and sediment filtration An adequate buffer next to streams and riparian areas from such impacts is a required conservation practice

Impacts from timber harvest will be minimized as described in the Resource Protection Measures section Some risk of impacts exists if activities are not carried out as planned, or if unexpected conditions are encountered The risk increases with more activity All alternatives are achievable, but based on different levels of activity, the relative risk between alternatives is shown in Figure 3-71

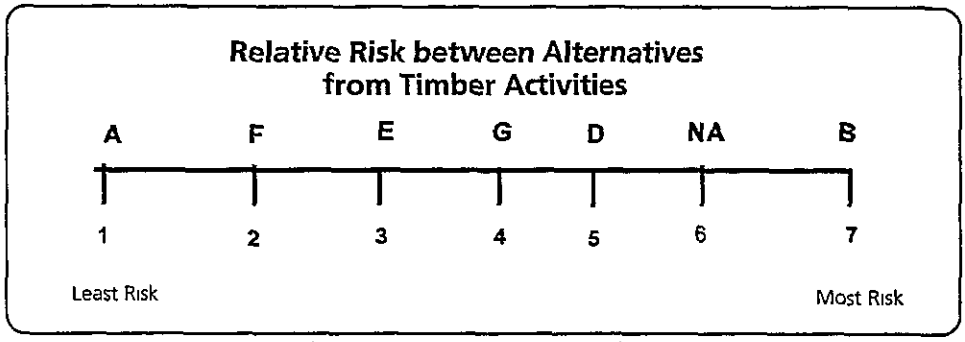


Figure 3-71. Relative Risk Between Alternatives from Timber Activities

Effects on Riparian Areas from Roads

Roads can significantly disrupt normal riparian area functions, by removing vegetation and altering water availability Proper management is to build roads outside riparian areas and only cross them when absolutely necessary, and then only at well-designed crossings

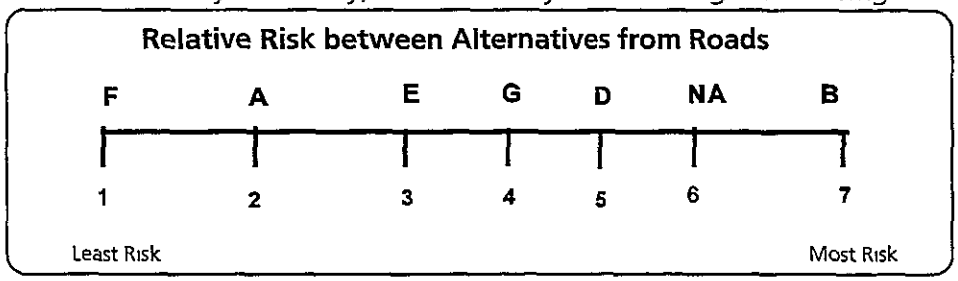


Figure 3-72. Relative Risk between Alternatives from Roads

Watershed conservation practices require proper location and design of roads When they are implemented, virtually all riparian area impacts are avoided Road closures to motorized travel are proposed for all alternatives Closing and rehabilitating road surfaces will reduce impacts from past activities

Mitigation of road impacts will be constant in all alternatives If mitigation is properly applied, there will be little difference in impacts between alternatives Alternatives with more road activity have some increased risk that impacts on riparian resources will occur, from unanticipated problems or failure to apply mitigation correctly (or from illegal public uses) That level of risk is shown in Figure 3-72

Effects on Riparian Areas from Fire

Low-intensity fires cause less surface disturbance than high-intensity ones Prescribed fires, in which the timing and behavior of fire are controlled, minimize negative effects on riparian areas Disturbances that are part of controlling fire need to be kept out of riparian areas, unless needed to prevent fire damage of riparian vegetation

Little difference in effects from fire is expected between alternatives Alternatives A and F may have more opportunities for prescribed natural fire Wildfires may be larger in these two alternatives, due to lack of access

Effects on Riparian Areas from Grazing

Riparian areas are naturally preferred by animals, both wild and domestic, especially during the summer, because of available water, desirable forage, and shade. Livestock and wildlife grazing often affect riparian areas

Overgrazing effects accumulate over a period of years. They include trampling, rubbing, and reduced vigor and density of plants These effects can seriously change the character of a riparian area Changes in plant composition and vigor can eliminate stable banks as deep-rooted plants (like sedges and willows) are replaced by shallow-rooted ones (like Kentucky blue grass) Overhanging banks can be broken off by trampling Riparian areas can diminish in size as streams become wider and shallower from bank trampling

Conservation practices are designed to limit grazing use of good-condition sites, prevent declines in stream and riparian health, and allow recovery for sites that still show signs of past impacts The Forest will use direction like that described in the General Technical Report, *Managing Grazing of Riparian Areas in the Intermountain Region* (Clary and Webster, 1989) This direction provides for adequate regrowth, after use, to maintain plant vigor and stream bank protection This can be accomplished by requiring stubble height minimums, depending on site conditions, to determine when livestock should be moved Livestock use and distribution must be controlled A variety of techniques are available, including herding, adjusting season of use, developing alternate water sources, salting, and, if necessary, fencing for special-use pastures

Sites that are seriously degraded (early ecological status, defined as 25 % or less of potential vegetation) can be assigned greater stubble heights, to further limit use and achieve improvement Degraded conditions on especially sensitive sites, like fine-textured or poorly armored stream banks, may require rest for a period of time, to achieve desired conditions

There is some risk of impacts from grazing. Wildlife populations could outgrow available forage. Conservation practices might be misapplied, or could be inadequate for unexpected circumstances These risks are not expected to be significant in any alternative Risks would decrease in Alternatives A, E, and F, because they have the potential to reduce livestock use

Effects on Riparian Areas from Mining

Mining can also cause significant impacts Acidic water can kill riparian vegetation. Tailings can cover riparian areas Some mining simply disturbs the surface, but placer operations can destroy stream banks as material is dredged and processed Exploration can leave surfaces exposed to erosive forces.

Past problems were described in the Affected Environment section. Future activities cannot be eliminated, but can be constrained to protect riparian areas Mining is not expected to vary by alternative, we expect that about 40 acres will be disturbed during the ten-year planning period Little to none of this activity is expected to occur in riparian areas

Effects on Riparian Areas from Recreation

Riparian areas are a favorite place for people to recreate Concentrated use of these areas can impact the vegetation that normally protects the sites It can also cause soil compaction

A key to protection is the proper location of uses Some developed campsites have been situated within riparian areas, and should be moved as opportunities become available Dispersed camping is discouraged in riparian areas Horses need to be pastured away from riparian areas

Use of off-road vehicles is becoming much more popular Many hypothetical impacts can result Severity of damage is directly related to the intensity and location of use (Bury, 1980) Use on the Forest will be restricted to roads and trails Game can be retrieved with All terrain vehicles (ATVs), but this is not expected to cause impacts, because use is dispersed and limited to certain areas of the Forest ATVs also have balloon tires that cause little surface disturbance, and use is limited to short durations To determine which trails should be designated for motorized and nonmotorized use, the Forest considered many factors Sensitive locations, like riparian areas, were among them

Recreational mining can damage riparian vegetation Stipulations attached to operating plans are intended to mitigate damage of surface resources

Recreation has been increasing on the RGNF, and increased use means increased potential for impacts on riparian areas To help alleviate them, new concentrated-use facilities will be situated away from riparian areas Dispersed camping next to water bodies will be discouraged Impacts will be monitored and use regulated, if necessary, to prevent adverse impacts

As more land is allocated to recreational uses, the risk of impacts on riparian areas goes up The relative risk between alternatives is shown in Figure 3-73

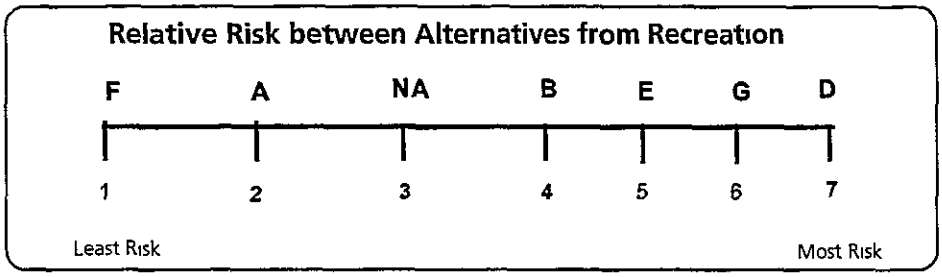


Figure 3-73. Relative Risk between Alternatives from Recreation

Effects on Riparian Areas from Oil and Gas Leasing

No significant effects are expected from oil and gas leasing Exploration can involve surface disturbance if new roads or drill pads are constructed Standard Stipulations are used to protect riparian areas

If exploration revealed producible quantities of oil or gas, a producing field could be developed The effects from such a field would include more surface disturbance, as well as potential contamination from the produced water and oil

As with all large surface-disturbing activities, these disturbances would have to be situated away from riparian areas Conservation practices require containment of storage tanks, as well as location of chemical storage and waste dumps on gentle, upland sites

Disturbances and activities would vary slightly by alternative Alternatives A and F would involve only one well and about 14 acres of disturbance All other alternatives are projecting 23 exploration and development wells, with about 129 acres of disturbance

CUMULATIVE IMPACTS

Riparian areas can tolerate a certain amount of use and disturbance without breaking down The RGNF intends to manage disturbances so that the cumulative total remains within an acceptable range of disturbance needed to provide habitat and continued use of riparian areas

This will be accomplished by including riparian areas in assessments of watershed cumulative impacts of all past, present, and foreseeable future disturbances Project analysis will also include an assessment of disturbances close to stream channels and riparian areas The assessment will involve measuring riparian condition and comparing it to reference areas. If riparian condition has been impaired, new activities will be avoided, or mitigated to prevent further impairment and allow recovery The intent is to reduce disturbances in riparian areas as much as possible

Overall, the risk of impacts on riparian areas is proportional to the extent of surface-disturbing activities All impacts will be mitigatable, but relative risk to riparian health would vary by Alternative, as shown in Figure 3-74

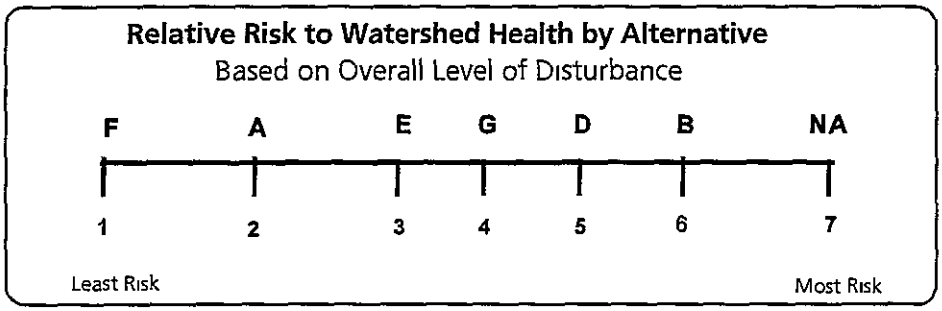


Figure 3-74. Relative Risk to Watershed Health by Alternative Based on Overall Level of Disturbance

INSECTS AND DISEASES

ABSTRACT

Although most people feel that the RGNF should be "healthy," "forest health" is a concept that has many definitions. With a basis in human values, the idea of forest health depends greatly on who is defining it Most authors agree that management objectives need to be determined before measures of forest health can be assessed

The roles of forest insects and diseases are as important as that of fire in changing the composition and structure of the forest ecosystem

There are two important groups of insects defoliators and bark beetles On the Forest, the western spruce budworm is the most prominent defoliating insect, and the spruce beetle and mountain pine beetle are the most prominent bark beetles

Three groups of pathogens are affecting the Forest. dwarf mistletoes, root diseases, and stem decays

Populations of some pest species are higher than have previously been experienced, largely due to fire suppression and harvesting practices Several Forest landscapes contain late-successional single-species stands susceptible to insect and disease attack Of 1,031 stands surveyed, dwarf mistletoe occurred to varying degrees on about 92% of the total acres

The two most frequently encountered root diseases on the Forest are *Armillaria* and *annosus* root disease According to surveys, 5 3% of trees surveyed showed signs of stem or butt decay

Epidemics or outbreaks of insects or disease are highly random and extremely difficult to predict Most insect or disease "change agents", however, are restricted to specific host species and/or size classes By increasing the diversity of Forest stands, we decrease the risk that any one insect or disease will cause large-scale damage

Uneven-aged management creates favorable conditions for the spread of dwarf mistletoes, root diseases, and western spruce budworm Even-aged management provides favorable conditions for mountain pine beetle

Insect and disease populations are not expected to change appreciably for the ten-year period of the Plan Potential exists throughout most Forest cover types for large-scale infestations, especially from western spruce budworm, dwarf mistletoe, and root diseases

INTRODUCTION

Legal Framework

Several federal statutes apply to Forest Service responsibilities concerning insect and disease activities The *National Forest Management Act of 1976* (NFMA), the *Forest and Rangeland Renewable Resources Planning Act of 1974*, and the *National Environmental Policy Act of 1969* require assessing various management techniques to develop a balanced, integrated approach to resource protection and development Specifically, the NFMA also requires "sound management practices to prevent excessive losses due to pests "

The *Cooperative Forestry Assistance Act of 1978* designates the Secretary of Agriculture as the primary federal official responsible for forest insect and disease management This Act "recognizes the need for public and private cooperation in combating forest insects and diseases and the need for Federal leadership and financial assistance on all forest lands "

Insects and Disease in the Forest Ecosystem

The roles of forest insects and diseases are as important as that of fire in changing the composition and structure of the forest ecosystem Although fire's effects are usually more acute and more visible, insects and diseases often cause greater changes in the forest ecosystem because they are more widespread and act over long periods of time

Historically, insects and disease affecting timber resources were frequently seen as "pests" to be managed or, if possible, eradicated "Control" of infestations usually consisted of salvaging dead and dying trees and suppressing insect and disease populations, via harvest activities, only after they had reached damaging levels. Additionally, forest managers have prescribed harvests that favored large-scale, single-age-class monocultures, fostering conditions that lead to insect and disease outbreaks.

The recent drive toward a more holistic view of forest management has brought with it a changing perspective on the activities of insects and disease As humans learn more about the complicated relationships that occur in the forest ecosystem, they are coming to realize the important roles that insects and disease play in the cycles of growth and decline Without the influence of "change agents" in the forest (fire, insects, and disease), it would stagnate and eventually become homogeneous—with a resultant negative impact on biodiversity These change agents are thus an integral part of forest ecosystem processes

Insect and disease disturbances still pose a challenge to forest management, when they occur in the "wrong" place or time. The impacts of these disturbances can be readily seen for many years after an infestation has run its course The moderate to severe defoliation in mixed- conifer stands along the Silver Thread Scenic Byway, caused by western spruce budworm, is a case in point Another is a spruce beetle epidemic, near Crystal Lakes on the Divide Ranger District, that caused widespread mortality in Engelmann spruce stands Most of the dead and dying trees were harvested with salvage sales The loss of the overstory in this area will be visible for many years to come

There has been much discussion concerning the issue of "forest health," both in the media and other public forums Everyone wants to have forests that are "healthy," but forest health means different things to different people To one person a healthy forest is a young plantation of vigorously growing ponderosa pine To another, a healthy forest is "dark timber," with lots of deadfall on the ground and mushrooms growing on the forest floor

The definition of forest health is a much debated issue within the forest protection community As early as 1949, Aldo Leopold suggested that "health is the capacity of the land for self-renewal " Wilson (1991) wrote that "a healthy forest is a description of a productive, resilient, and diverse forest ecosystem, a forest with a future "

Maintaining forest conditions that are consistent with management objectives is a theme common to many definitions of forest health This utilitarian definition is typified by the one found in the USDA Forest Service publication, *Forest Health through Silviculture and Integrated Pest Management -- A Strategic Plan* (1988) This document explicitly states, "For purposes of this report, a desired state of forest health is a condition where biotic and abiotic influences on the forest do not threaten management objectives for a given forest unit now or in the future "

What is meant by forest health is discussed at length in an article by Kolb et al (1994) The authors examined many of the concepts that have been used in discussions of this subject Various viewpoints have been expressed, from the strictly utilitarian perspective to the comparison of forest conditions to the health of an individual organism As time has passed, most contributors to the field have concluded that forest health is based on various human values, and is not a scientific term per se. The concept is useful, however, when attempting to communicate ideas regarding management objectives When all parties can agree on what is meant by it, forest health is a valuable tool in helping compare actual versus desired forest conditions

In southern Colorado, frequent fires once played an important role in the maintenance of seral species like pine and aspen, and the replacement of decadent and/or diseased trees with young, vigorous trees When the RGNF was established in 1908, an emphasis was put on controlling forest fires At lower elevations, the exclusion of fire practiced for the last 85 years has resulted in stand structures and species compositions that are more susceptible than earlier stands to several pest problems These problems include root disease, stem decay, and extensive defoliation by western spruce budworm (See Appendix A, Range of Natural Variability Report)

A prime example of the interrelationship between fire, insects, and disease is dwarf mistletoe. Fire is perhaps the key agent that controls the delicate equilibrium between dwarf mistletoe and its host in the natural ecosystem When a stand becomes infested with mistletoe, some trees are killed outright Surviving trees produce brooms (tumor-like growths on tree limbs that contains branches growing haphazardly and at "odd" angles) and resinous stems and branches

Heavy witches-brooming creates concentrated fuel for "torching" and destruction of infected trees, whereas normal tree crowns are less likely to carry fire up the tree The low-severity fires formerly common in southern Colorado would often flare up and consume most of these infested trees in localized infection centers, thus sanitizing the stand. In this

manner, fire periodically removed most of the dwarf mistletoe from infested stands, resulting in low pathogen levels in the subsequent regeneration

Unfortunately, with fire suppression and the disruption of this cycle, dwarf mistletoe and associated damage have increased greatly Because dwarf mistletoe also spreads more quickly through uneven-aged stands, fire suppression has also indirectly contributed to its spread, by favoring more multi-aged stand conditions

Early selective-logging practices have also hastened the rate at which seral species are replaced by shade-tolerant species. "Selected" for harvest were large, high-value trees, mainly ponderosa pine Thus harvesting removed the more disease-resistant species of a stand and left the more susceptible ones. In addition, residual trees were often damaged during the harvests. Damaged trees, with freshly cut stumps, offered entry points for root diseases and stem decays Furthermore, stressful growing conditions caused by overstocking, soil compaction, and disturbance resulted in trees succumbing to insects and disease (most notably bark beetles and root diseases) that they might have resisted, had they been vigorous

The predominance of shade-tolerant tree species, notably Douglas-fir and true firs, has created favorable conditions for the western spruce budworm These tree species are the preferred host for this insect, and these forest conditions have resulted in widespread outbreaks of it.

In recent years, concern about the effects of even-aged management has resulted in greater use of uneven-aged systems in timber management on the RGNF While uneven-aged management is clearly desirable under some conditions—as in areas where maintenance of a mature forest cover is preferred—it is inappropriate where certain insect or disease infestations are occurring. There are at least three situations on the RGNF where uneven-aged management encourages the spread of disease and insect populations

In areas where root disease exists, uneven-aged management will exacerbate disease problems since stumps left behind after harvesting will serve as inoculum (a food source) for the fungal organisms The large supply of food will then serve as a reserve for the disease organism to remain on the site and infect future regeneration When given a continuous supply of food, fungal-disease organisms can remain virulent on a site for well over 50 years

Uneven-aged management can also encourage the spread and growth of dwarf mistletoe In an uneven-aged stand, an infected overstory will shower the younger age classes with mistletoe seed The heavy deposition of mistletoe seed in the understory will increase the amount of mistletoe in a stand eventually In pre-European times, stands that carried a heavy mistletoe load were often subject to stand-replacing fires These fires were particularly intense in trees with high mistletoe loads These fires removed all infested trees and returned the stand to an even-aged condition, making it more resistant to mistletoe With prolonged fire exclusion, many stands on the RGNF currently have high mistletoe levels In areas where fire will continue to be excluded, the use of even-aged management and small-scale clearcuts will be the only tool managers have to sanitize heavily infested stands.

Uneven-aged-stand conditions are also favorable to the western spruce budworm An understory of regeneration acts as a "safety net" for the young caterpillars Caterpillars dislodged from branches by wind, or as they travel through the tree crown, are caught by the branches of lower trees in an uneven-aged stand, where they can continue to feed In an even-aged stand, these caterpillars fall to the ground, where many die. The effect of an uneven-aged stand structure on western spruce budworm population dynamics is evidenced by the fact that defoliation is typically much worse in uneven-aged stands, with the foliage of the understory supporting high degrees of defoliation

As previously mentioned, a direct connection between timber management activities and insects and disease is seen in stands where poor harvesting techniques are evident The scarring and damaging of residual trees in a stand can be the foundation for insect and disease outbreak. Severely damaged trees can serve as a focus for bark beetles and wood borers, and wounds in trees can serve as infection points for many fungal diseases. Again, uneven-aged management, which requires more frequent entry into stands, can result in increasing risk of loss from insects and disease

However, just as timber management activities can create conditions that favor insect outbreaks, certain timber management practices can create conditions that discourage insect outbreaks No single silvicultural system will alleviate all insect and disease problems in a stand Frequently a manager may have to choose "the lesser of two evils" when prescribing specific management activities For example, choosing even-aged management in a lodgepole stand will reduce the risk of loss due to dwarf mistletoe, but will increase the risk of loss due to mountain pine beetle

There are tremendous difficulties associated with insect and disease management The huge scale of the Forest makes it difficult to carry out any sweeping changes in stand conditions A serious information gap, particularly up-to-date inventory information, exists as well Computer models have helped managers understand how insects and disease affect the forest environment, but they do not incorporate the innumerable interactions between insects and disease and other forest elements In addition, scientific information is lacking on how well the complex silvicultural treatments now being used to mitigate the undesirable effects of insects and disease are working Regardless, one principle has become clear to forest managers Only by encouraging a mosaic of size/age classes, stocking levels, and species mixes can we expect to reduce the impact of insects and disease

Range of Natural Variability Conclusions

* Ponderosa pine stands are susceptible to infestations of mountain pine beetle

* Large portions of the RGNF are susceptible to infestation by the western spruce budworm

* Tent caterpillar outbreaks today may be smaller and less numerous than outbreaks that occurred prior to settlement

* The number of spruce beetle outbreaks during pre-settlement times is probably not significantly different from the amount of spruce beetle outbreaks after settlement

* There has been a slow but steady increase in the negative impacts of root disease on the RGNF, particularly in the spruce/fir and mixed-conifer cover types

AFFECTED ENVIRONMENT

Insects and diseases have had, and are presently having, a significant effect on the structure, species composition, and condition of the forest ecosystem of the RGNF. Three groups of pathogens are affecting the Forest. dwarf mistletoes, root diseases, and stem decays. There are two important groups of insects. defoliators and bark beetles.

Although these insects and diseases are native to the forest ecosystems of southern Colorado, populations of some of these organisms are higher than has been previously experienced Often this is due to fire suppression and the harvesting practices of the past 85 years These practices have created many landscapes containing late-successional single-species stands susceptible to insect and disease attack

Table 3-48 displays insect-caused forest damage and mortality data by cover type for the RGNF This information was compiled from inventory data gathered in the late 1970s and 1980s The data do not include growth loss caused by sublethal populations of insects and diseases, which is believed to be significant

Table 3-48 Annual mortality of 5"+ trees by insects and disease

COVER TYPE	% OF ANNUAL GROWTH KILLED BY INSECTS & DISEASES	% DAMAGED BY INSECTS & DISEASES
Aspen	8 1	25 8
Spruce/fir	15 1	11 0
Lodgepole Pine	22 8	5 1
Ponderosa Pine	5 9	6 9
Douglas-fir	9 5	10 4

In interpreting Tables 3-48 through 3-50, it is important to realize that the data on which the tables are based were never meant to provide comprehensive information about losses due to insects and disease As previously pointed out, in the past, forest health management activities were often a response to crises such as outbreaks and epidemics As a result, routine timber inventories frequently neglected to include general insect and disease data The more recent emphasis on a holistic approach to forest health management will help to rectify this situation Meanwhile, it is difficult to use general Forest inventory data to produce a detailed picture of insect and disease activity

One drawback of the timber inventory data used to produce the tables shown is that timber types were categorized by the dominant tree species In other words, if a stand was 60% aspen and 40% Douglas-fir, any insect or disease found there on either the aspen or the Douglas-fir would be included in the tally for the aspen cover type Thus we have the unlikely appearance of listings for mortality due to mistletoe in "aspen" stands Aspen is not a host of mistletoe, but mistletoe mortality in the "aspen" stand will be found in the host species, Douglas-fir

Insects and Diseases of the Rio Grande National Forest

The following information will briefly outline the occurrence, estimated levels of impact (if known), and characteristics of the five major insect and disease types It is especially important to note the hosts for each insect and disease Although the specific cause of mortality in each cover type is not known, knowing the major impact organisms for each cover type will reveal the causal organisms For example, in the lodgepole pine cover type, the major insect and disease impacts are mountain pine beetle and dwarf mistletoe Obviously, spruce beetle will not be a problem in lodgepole pine stands

Dwarf Mistletoe Dwarf mistletoes are among the most damaging forest diseases in Colorado They damage their host by reducing growth, lowering wood quality, and killing or predisposing it to attack from other insects or diseases Dwarf mistletoe is widely distributed on the RGNF Three species are found on the Forest lodgepole pine dwarf mistletoe (*Arceuthobium americanum*), ponderosa pine dwarf mistletoe (*A vaginatum* ssp *cryptopodum*), and Douglas-fir dwarf mistletoe (*A douglasii*) Though occasionally found on other hosts, each of the dwarf mistletoes is largely specific to its named host species

According to surveys of 1,031 stands on the RGNF, dwarf mistletoe occurs at some level of severity on an estimated 92% of the total acres inventoried Breaking this out by type, dwarf mistletoe occurs on an estimated 64% of the inventoried acres of spruce-fir type, 87% of the lodgepole pine, 100% of the ponderosa pine and Douglas-fir types, and 44% of the aspen type

Table 3-49 further breaks down mistletoe occurrence in each major type, based on size class and susceptible species While analysis of the survey data showed that the dwarf mistletoes are widespread, it also showed that the average infection intensities on the Forest (as classified by the Hawksworth 6-class dwarf mistletoe rating system) are relatively low The data, however, presented dwarf mistletoe levels from combined stands (containing both healthy and diseased stands), and

Table 3-49 Dwarf Mistletoe Occurrence by Cover Type and Size Class

COVER TYPE	% OCCUPIED BY HOSTS OF DWARF MISTLETOE	% OF HOSTS INFECTED BY DWARF MISTLETOE
SPRUCE/FIR		
Mature	1	67
Pole	3	38
Seedling/Sapling	1	0
TOTAL	1	64
LODGEPOLE PINE		
Mature	53	100
Pole	84	79
Seedling/Sapling	98	100
TOTAL	80	87
PONDEROSA		
Mature	42	100
DOUGLAS-FIR		
Mature	44	100
Pole	61	100
TOTAL	48	100
ASPEN		
Mature	5	100
Pole	3	9
Seedling/Sapling	1	100
TOTAL	3	44

did not provide the means to analyze separately the infection levels of individual diseased trees and stands Stands that contain the disease undoubtedly vary in infection intensity, from light to severe

Currently, the amount of growth loss and mortality on the Forest due to mistletoe, though undoubtedly considerable, has not been documented Quantifying the impact of mistletoe is difficult because its effect is subtle, apparent only over a long period and governed by a complex array of factors, some of which include

* Age at which host trees become infected Trees infected late in the rotation experience negligible to no effect, in contrast to trees that are infected early and may never reach a merchantable size

* Rate of height growth on the tree versus the ability of the mistletoe to spread within the tree

* Stand structure, density, species composition, and management activities all affect the ability of mistletoe to infect adjacent trees

Although losses from dwarf mistletoe are not as visible as those caused by insects, the cumulative impacts of growth and mortality are considerable over the life of a forest stand, and across the Forest These impacts in turn may negatively affect scenic, recreation, wildlife, and commodity values

Dwarf mistletoe is the one forest pathogen which can be clearly affected by management practices Several techniques can severely reduce the impact of dwarf mistletoe in a forest stand Removal of infested trees by cutting or prescribed burns, and/or establishing a buffer zone to prevent reinfestation of regeneration, can remove dwarf mistletoe from management considerations for many years Conversely, failure to recognize the dwarf mistletoe's impact in a stand and the inappropriate use of uneven-aged-management systems, can greatly increase the impact of dwarf mistletoe

Root Diseases Root diseases affect trees in several ways Loss of structural support, as roots become decayed, often leads to death of host trees by windthrow Mortality also occurs directly by girdling of the roots In addition, root-disease infection may stress host trees to the point where they become susceptible to mortality agents, such as bark beetles or drought

On the RGNF, the two most frequently encountered root diseases are Armillaria root disease, caused by *Armillaria* sp , and annosus root disease, caused by *Heterobasidion annosum* In a survey of conifer root diseases on the San Isabel, Rio Grande, San Juan, and Grand Mesa National Forests, James and Goheen (1980) identified Armillaria root disease on all commercially important species of conifers and hardwoods, including white fir, subalpine fir, lodgepole pine, ponderosa pine, Douglas-fir, Engelmann spruce, pinon pine, rocky mountain juniper, and aspen

The disease affects trees of all ages, though smaller and less vigorous trees typically succumb more rapidly to the girdling action of the fungus Armillaria is particularly damaging on the true-fir hosts While damaging in young (up to 25 years old) lodgepole pine hosts, *Armillaria* sp ceases to be a management concern in older lodgepole pines (Sharon, 1988)

Armillaria lives as a saprophyte on dead organic material, such as old stumps left from logging Survival of the fungus in old dead stumps for up to 50 years is not uncommon From stumps, the fungus can spread to living hosts by root contacts and "rhizomorphs " These are red-brown or black cords of fungal mycelium, which typically look like shoestrings It is from these structures that Armillaria gets one of its common names, "shoestring root disease " Rhizomorphs can grow through the soil from the food base to the roots of living trees Continued spread by root contacts results in the typical patchy distribution of the root disease, often with mortality in the middle of the expanding disease centers

In an assessment of various surveys of root diseases in the Rocky Mountain Region, Armillaria is commonly associated with trees attacked and killed by bark beetles and woodborers (Johnson, 1984) A study conducted in the Colorado Front Range showed that 62% of the mountain pine beetle-killed ponderosa pines were also infected with Armillaria

On the RGNF, annosus root disease is most damaging on white and subalpine fir Detailed information regarding the incidence and impacts of annosus root disease on the Forest is lacking A roadside survey by James and Gillman (1979) identified annosus root disease on white fir, however, on the Conejos Peak and Saguache Ranger Districts In an additional roadside survey of true-fir mortality centers in southern Colorado (San Juan, San Isabel, Rio Grande, and Grand Mesa National Forests), James and Goheen (1980) found 59% of the white fir and 3% of the subalpine fir, when examined closely, were infected by *H. annosum*

Heterobasidion annosum causes a white, stringy root and butt decay of trees of all age classes As with Armillaria root disease, mortality occurs in groups due to root-to-root spread of the disease In addition, aerial spread of the disease occurs from airborne spores, which infect surfaces of freshly cut stumps and wounds Sporophores, which produce the spores, are found within infected stumps and dead trees, or at the base of infected trees under the litter layer The fungus has been found in uncut stands where natural wounds may have provided infection "courts", however, mortality is more extensive in stands that have been partially cut

Stem and Butt Decays Stem and butt decays, which enter their hosts through wounds, directly affect wood yield and quality Extensive decay also results in a loss or reduction in the structural integrity of standing trees, resulting in increased susceptibility to breakage While important from a commodity viewpoint, hazards due to stem breakage are also of extreme concern in developed recreation areas (campgrounds, picnic grounds, trails, and scenic overlooks) In these locations a single fallen tree can easily

Table 3-50 Incidence of Stem and Butt Decay by Cover Type

	PERCENT OF TREES IN COVER TYPE		
COVER TYPE	BUTT ROT	STEM ROT	STEM OR BUTT ROT
Spruce/fir	15	21	36
Lodgepole Pine	04	08	12
Ponderosa Pine	09	12	21
Douglas-fir	16	20	35
Aspen	23	76	99
TOTAL	16	37	53

result in a tragic loss of life or property

On the RGNF, a variety of stem decays and butt rots are found in all cover types. Based on surveys of 1,031 stands throughout the Forest, 5 3% of the trees (all cover types) showed signs of stem or butt decay (Table 3-50 displays the incidence of these decays by cover type)

Defoliating Insects Most prominent among the defoliating insects on the RGNF is the western spruce budworm, *Choristoneura occidentalis* The budworm feeds on the foliage of the following tree species (in order of preference). Douglas-fir, white fir, subalpine fir, blue spruce, and Engelmann spruce

This insect, which has been at outbreak levels in large contiguous areas of the Forest, can cause extensive tree mortality, top-kill, and growth loss Over the last several decades the susceptibility to budworm outbreaks on the RGNF has increased in the mixed-conifer type, due to the favorable host habitat—multi-aged stands of shade-tolerant species While budworm outbreaks have always occurred in southern Colorado forests, studies have shown recent outbreaks to be more extensive and damaging than in the past By analyzing tree-ring growth patterns, scientists can create "reconstructions" of past growth conditions

To figure out the budworm's historical trends, Swetnam and Lynch (1989) did a tree-ring reconstruction of western spruce budworm outbreaks on the Colorado Front Range and the Sangre de Cristo Mountains of New Mexico At least nine outbreaks were identified between 1700 and 1983 The average duration of the outbreaks was 12 9 years The average interval between initial years of successive outbreaks was 34 9 years Swetnam and Lynch found that the average maximum and periodic growth reductions were 50% and 21 7%, respectively These results further suggested that outbreaks since the early part of the twentieth century have been more extensive and more damaging than those in previous decades.

Even-aged silviculture is preferred in locations with a history of western spruce budworm outbreaks Shelterwood prescriptions that attempt to maintain a mix of species can reduce impacts of existing budworm outbreaks, and also reduce stand susceptibility to future outbreaks

Bark Beetles Two bark beetle species are very important on the RGNF the spruce beetle, *Dendroctonus rufipennis*, and the mountain pine beetle, *Dendroctonus ponderosae*.

The tree-killing potential of the spruce beetle has been well documented during the last 100 years This insect infests all species of spruce in North America On the RGNF, Engelmann spruce is the principal host Spruce beetles generally prefer to attack green windthrown or other recently downed spruce As a result, endemic beetle populations are always present in spruce/fir forests, breeding in scattered down material.

Outbreaks generally begin after a major forest disturbance (e g , a large windthrow event) creates an abundance of suitable breeding material (Schmid and Mata, 1996) Beetle populations rapidly increase in the down material and then readily attack standing spruce Outbreaks may persist until suitable host material is depleted

A stand's susceptibility to spruce beetle outbreaks is dependent on its physiographic location, the average diameter of the spruce in the stand, the basal area of the stand, and the proportion of spruce in the canopy In general, spruce stands on well-drained creek bottoms having large-diameter spruce, high basal areas, and high proportions of spruce in the canopy are susceptible to outbreaks

The last outbreak in standing timber in the Rocky Mountain Region occurred between 1980 and 1985, in the Crystal Lakes area on the Divide District, RGNF The outbreak occurred after a windstorm created scattered windthrown trees throughout a timber sale area that had been harvested in the 1960s Spruce beetle populations built up in the windthrown trees and spread to adjacent spruce stands, resulting in an extensive spruce beetle outbreak

The mountain pine beetle, *Dendroctonus ponderosae* Hopk , is a native species of bark beetle that has a great impact on the dynamics of Western forest stands This insect is considered the most important bark beetle species in western North America, due to the dramatic influence it exerts in the economically important pine forests of the West (Furniss and Carolin, 1977) It has an extensive geographic range, from the pine forests of Canada south through the U S , and into the northern states of Mexico

The mountain pine beetle attacks a wide range of pine species, but its primary hosts are lodgepole pine, sugar pine, western white pine, ponderosa pine, and whitebark pine The mountain pine beetle is especially important to stands of lodgepole pine and ponderosa pine, and has long been considered a scourge of western lumbermen There have been no widespread outbreaks of mountain pine beetle on the RGNF in recent history The close ecological ties, however, between the mountain pine beetle and its hosts, ponderosa pine and lodgepole pine, make discussion of this insect imperative

Since the mountain pine beetle is a native species, it has co-evolved with its hosts and plays a significant role in the ecology of these tree species With increased understanding of the ecological function of the mountain pine beetle, its status as a "pest" has come into question, the mountain pine beetle may even be viewed as a symbiont of its host trees It is certainly a major player in the dynamics of pine stands throughout the West, and has responded to the changes in stand structure and dynamics that have occurred in the modern era

Adult mountain pine beetles are about the size of a grain of rice, and are cylindrical and dark-colored There is one generation per year in the Rocky Mountain region, with the insects overwintering as larvae beneath the bark of host trees The beetles undergo pupation in late June to early July, and emergence is triggered by warm, mid-afternoon temperatures in early August The adult females emerge first, the earliest emerging beetles are sometimes referred to as "pioneer beetles "

Attacking beetles produce an attractive pheromone which results in the phenomenon known as "mass attack " Many beetles act in concert to overcome the tree's defenses and establish brood within the host tree In order to produce brood (i e., the next generation of beetles) successfully, the host tree must be killed When beetle populations are such that many trees are killed, the beetles are said to be in an "outbreak" phase Bark beetle outbreaks can be major events in the forest ecosystem it is not uncommon for over a million trees to be killed in a single year (Cole and Amman, 1980)

The ecological succession of pine stands is greatly dependent on the influences of fire, insects, and disease These "change agents" set up a cycle that begins with a stand-clearing fire Nearby stands contribute pine seeds to the clearing, and the young pines grow rapidly in the sunny opening As they approach maximum height, occasional ground-level fires may sweep through the stand, but at this stage the stand is essentially immune to these low-intensity burns

Over time, however, some trees may become wounded by fires and occasional lightning storms. These infection courts open the trees up to the destructive influences of stem decay and root disease. In addition, climatic events such as drought may contribute significantly to stress. When most of the stand is under stress, the population of mountain pine beetle can expand to take advantage of the situation

Although there are several factors which affect the population status of mountain pine beetle, enough trees under stress can cause their numbers to explode Once "critical mass" is reached and the full-bore outbreak erupts, the beetles can expand out of the center and attack healthy trees The destruction of stands can be quite extensive, but eventually the epidemic subsides Left in the wake are many standing and fallen dead trees

In the past, these "ghost stands" represented a huge fuel supply for fires that would eventually break out The resulting fire would sweep through the old stands and sanitize them of the old timbers and competing shade-tolerant species The resulting clearing could then be colonized by pine seeds from the surrounding stands With the exclusion of fire, however, many patterns in pine stands have been disrupted (Gara et al , 1984)

Without fire, succession of pine stands leads to predominance of more shade-tolerant species such as Douglas-fir or the true firs. In addition, lumbering activities, beginning in the latter part of the 19th century and continuing into the 20th century, severely disrupted an even distribution of age classes throughout the range of pines

Because of these factors, many pine stands in the West are at high risk to widespread destructive events Whereas in the past, pine stands throughout a given region existed in a mosaic of various successional stages, the current condition of the stands is much more homogeneous This homogeneity has resulted in conditions conducive to the extraordinarily large events such as fires and beetle outbreaks that have occurred in the modern era

By avoidance of these conditions of large-scale homogeneous stands, the impact of bark beetles can be greatly reduced Bark beetles are particularly damaging in overstocked stands of the larger size classes, widespread even-aged stands are especially at risk When these stands exist over large acreages, the potential for a severe bark beetle outbreak can become great Bark beetle risk can be lessened by reducing stand basal area and the homogeneity of stand conditions

Predictions of Future Insect and Disease Impacts

The unpredictability of change agents such as fire, insects, and diseases can cause great problems for forest managers Their impacts often greatly affect forest management activities, and their unpredictability compounds the effects

From a management standpoint, it would be desirable to predict when and where change events are going to occur It is extremely difficult, however, to figure out the likelihood of fire, insects, and disease with a high degree of accuracy The greatest impediment to forecasting epidemics and outbreaks is the stochastic (highly random) nature of these events Because there are so many factors that contribute to and influence the roles of change agents, and they are so interconnected, these highly complex interactions occur almost randomly

For example, if we were to examine the population dynamics (the change over time in numbers) of the spruce budworm, we would see that there are several factors that influence the size of the population There are biotic factors, such as the numbers of natural enemies (birds, other insects, etc), the extent of disease in the population, and the influence of other competitors for the foliage A major biotic factor is the condition of the host trees i e , are the hosts vigorous and able to resist repeated defoliations, or are they under stress due to a lack of nutrients or sunlight?

There are interactions involved, as well—root disease may weaken a tree to the point where it may not survive repeated defoliation. Lack of fire may encourage the growth of mistletoe and further weaken the trees Finally, there is the important influence of climate This highly variable factor can positively and negatively affect the conditions of host tree and insect

There is a tradeoff between the specificity and the probability of predictions regarding forest insects and disease It can be said with 100% probability that there will be a mountain pine beetle epidemic somewhere on the RGNF within the next 100 years But this prediction is so unspecific as to be almost useless On the other hand, the probability that there will be an outbreak of mountain pine beetle in Drainage X within the next five years is likely only 5% Again, this is a weak prediction with little value for management purposes

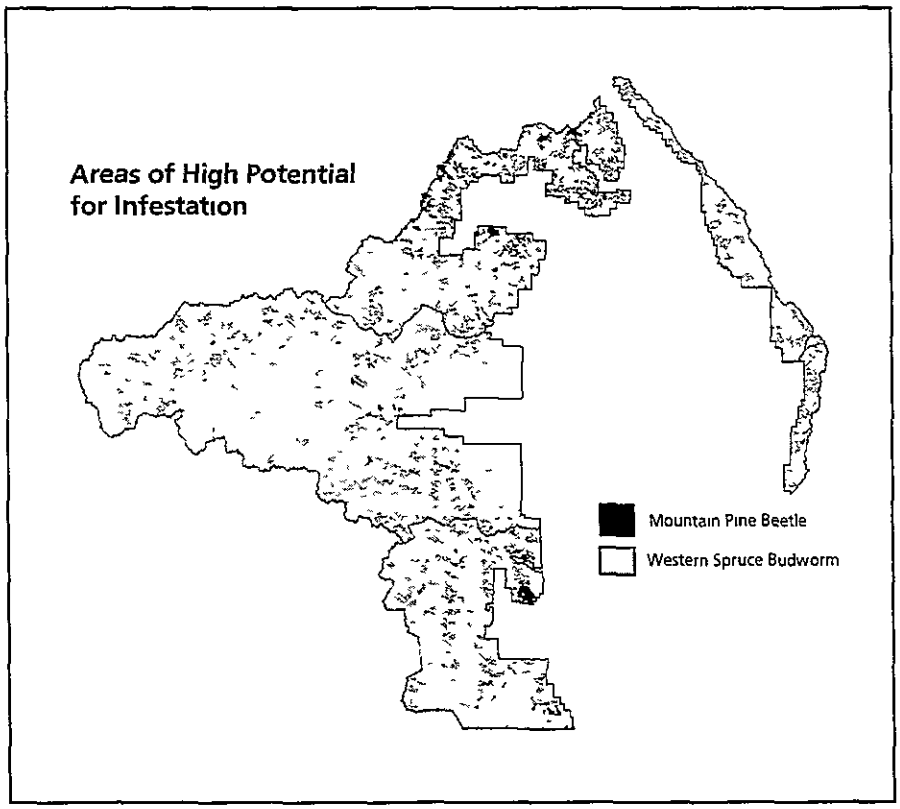


Figure 3-75. Areas of the RGNF with High Infestation Potential by the Mountain Pine Beetle and Western Spruce Budworm

Hazard rating does have great value in helping set management priorities Figure 3-75 shows areas of the Forest with significant percentages of host tree species for western spruce budworm and mountain pine beetle

Rather than make predictions regarding the time and place of epidemics and outbreaks, it is much more useful to speak to *trends* of insects and disease activity One important point to remember is that all of the individual insect and disease change agents are restricted to a specific host species and type Dwarf mistletoe is never a problem in Engelmann spruce, thus we can eliminate mistletoe outbreaks from the list of likely occurrences in spruce stands. Similarly, mountain pine beetle is never a problem in pole-sized ponderosa pine, so this possibility is likewise eliminated

By examining the prospective forest conditions, we can get an idea of what future problems will be If fire continues to be excluded from forest stands, the shade-tolerant species will continue to increase in extent Since these are the hosts of western spruce budworm, a continued exclusion of fire will result in eventual outbreaks of spruce budworm. To reduce the impact of any given insect or disease, it will be necessary to reduce its host type By increasing the diversity of forest stands, we decrease the risk that any one insect or disease will cause large-scale mortality

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Effects Common to All Alternatives

Mixed-conifer and ponderosa pine stands will, in general, continue to be at risk of widespread defoliation by western spruce budworm

The presence and severity of damage by dwarf mistletoes are expected to gradually increase

It is difficult to reconstruct the historical significance of root disease, but clearly certain management practices (such as attempting uneven-age management in areas infested with root disease) exacerbate this problem.

Effects Compared Between Alternatives

Alternatives B and NA emphasize more than other Alternatives Hence protection of Forest stands from insects and disease, and salvaging dead and dying timber from infestations, will be greater in these Alternatives Additionally, higher Forestwide road mileage, associated with Alternatives B and NA, can be assumed to offer greater access to infestations that may occur on the Forest

In contrast, Alternative A (and to a lesser extent, Alternative F) emphasizes minimal human influence on timber resources The intent of allowing ecological processes to function freely could result in minor to dramatic changes in Forest conditions It likely that dead and/or dying timber resulting from infestations will be more likely to be left standing on-site

(rather than be logged), for reasons of restricted (or no) access, and to reduce people's impact on these processes

The effects under Alternatives D, E, and G fall between those described for B/NA and A/F

Effects on Insects and Disease from Timber Management

All Alternatives allow for the cutting and/or removal of trees to meet other vegetation management objectives, such as hazard-tree reduction and sanitation/salvage harvesting Planned hazard-tree reduction will continue annually in developed recreation sites; the resulting influence on insect and disease populations is of little consequence

No sanitation/salvage harvesting is planned The degree to which these harvests are undertaken will depend on the risk of infecting healthy stands, public safety, the presence of high-value resources, the resource emphasis of the infected or adjoining area, and future risk of wildfires

Applying any Alternative, for the ten-year period of the Plan, will result in timber harvesting affecting a minor portion of the Forest (about 1% under Alternative B, experienced funding level, less for other Alternatives) Thus recent trends in insect and disease spread or risk may be assumed to continue In addition, the cover types perceived at greatest imbalance with "natural" conditions (ponderosa pine and Douglas-fir/ mixed-conifer types) have no scheduled harvests for the next ten years.

All Alternatives, except A, include planned harvesting dominated by uneven-aged management, which fosters root diseases, dwarf mistletoe, and western spruce budworm Conversely, Alternatives that use even-aged systems in infested harvest areas should result in reducing these populations Therefore, while Alternative B harvests the most acres with uneven-aged management, it also harvests the most acres under even-aged management, thereby inhibiting conditions for these agents (assuming experienced budget levels) (Refer to Figure 3-56 for a comparison of Alternatives on acres harvested by various silvicultural systems.)

Effects on Insects and Disease from Fire

Fires in forest stands can create conditions conducive to insect and disease outbreak The scarring and damaging effects of fire can put trees under stress and render them incapable of resisting insect and disease attack High temperatures can cause openings in the bark, which serve as infection sites for fungi and insects

Even scorched trees may succumb to insect attack This is especially true of lodgepole and ponderosa pines, which may be only slightly damaged by fire, yet be killed by bark beetles several years after the fire *Ips* beetles in particular are a problem in areas after a fire They appear to specialize in attacking trees put under stress by fire, and estimates of tree mortality due to fire cannot be considered complete until several years after the fire, during which time *Ips* will "pick off the stragglers "

Effects on Wildlife from Insects and Disease

The impacts of insect and disease activity on wildlife are both positive and negative, depending on the wildlife species in question Insects constitute a basic food supply for many wildlife species, so outbreaks of insects can mean an increased food supply for these species

Other relationships between insects and disease and wildlife are more subtle When insects or disease kill groups of trees, the resulting increase in solar radiation to the ground can significantly increase the amount of forage available to wildlife

A number of insectivorous birds rely on dead timber infested with wood-boring insects as a source of food In addition, standing dead trees serve a variety of functions for many wildlife species, including shelter and nesting sites

Mortality of trees from insects and disease can also result in loss of wildlife habitat Groups of dead trees give little or no thermal cover to wildlife Loss of this cover can result in alteration of wildlife movement and use patterns Changes in forest cover type that are brought about by insect and disease activity can also have a great impact on wildlife

Effects on Recreation from Insects and Disease

Concerns of recreational users of the Forest regarding the impacts of insects and disease are generally focussed on two key issues safety and visual effects Insects and disease can create "hazard trees" in areas that receive high recreational use Dead limbs in the crowns of trees, trees with structural weakness, and trees that may fall all pose a problem to recreational users It is Rocky Mountain Region policy that all campgrounds and developed picnic sites on National Forest System lands be inspected annually for hazard trees These surveys are meant to identify trees that pose a risk to Forest visitors and, if necessary, determine what actions need to be taken to mitigate these risks Recreational activity occurring elsewhere in the Forest is considered to be at the risk of the user

Opinions vary greatly regarding the influence of insects and disease on the visual quality of recreation sites At times it would appear that the presence of dead trees has little impact on recreation-site use On the other hand, surveys invariably show users prefer unbroken stands of vigorous, healthy trees It appears that while Forest visitors prefer the appearance of undamaged stands, in actuality they are willing to use areas with large amounts of apparently dead trees

One valuable function of stands that have undergone significant impacts from insects and disease is to serve as educational aids For example, interpretive signs near bark beetle outbreaks have done much to educate the public regarding the roles of fire, insects, and disease in the forest ecosystem As the public's desire for participating in Forest management grows, it is necessary for the Forest Service to give the "whole story" to those who are interested

CUMULATIVE EFFECTS

The status of forest insects and disease on the RGNF reflects long periods of adaptation between these insects and diseases and their host species It also reflects nearly 90 years of fire suppression and harvest activities

Planned activities associated with any of the Alternatives, for the ten-year period of the Plan, will affect an extremely small percent of the Forest Therefore insect and disease populations are not expected to change appreciably for the next ten years.

Great potential exists throughout most Forest cover types for large-scale infestations of insects or disease Potential for damage from western spruce budworm, dwarf mistletoe, and root diseases is likely greater than before European colonization of the area

FIRE AND FUELS MANAGEMENT

ABSTRACT

The RGNF fire management program has two purposes One is to protect resources with fire prevention, presuppression, fuels treatment, and suppression The second purpose uses prescribed fire to protect, enhance, and maintain ecosystem characteristics. This includes using both Prescribed Natural Fire (PNF) and Management-Ignited Fire (MIF) to meet Forest management Goals and Objectives.

Since the majority of fires on the Forest are lightning-caused, wildfire occurrence will remain within the historic range (the past 20 years) Due to the nature of the predominant fire regimes on the Forest, and their associated fire behavior, potential changes in acreage, per Alternative, can be addressed only in very broad, nonspecific deductions

The variations in timber harvesting in the Alternatives will affect the fire management program in different ways Lower-harvest Alternatives will allow for more large-scale development and implementation of Prescribed Natural Fire plans Alternatives that increase allowable-timber-harvest areas will necessitate a more limited PNF program and a more intense fuel treatment and fire suppression program

Another situation that will affect the fire management program is the increase in rural development in areas bordering the National Forest As more development occurs, emphasis will be needed on reducing hazard fuels next to these areas There is also an increased need for public education on the hazards involved and the mitigation methods employed when development occurs adjacent to wildland fuels

Legal Framework

The following acts contain legal requirements and authorities to plan and carry out activities to protect National Forest System lands and resources from fire

* *The Organic Administration Act of 1897* (16 U S C 551) authorizes the Secretary of Agriculture to make provisions for the protection of National Forests against destruction by fire

* *The Bankhead-Jones Farm Tenant Act of 1937* (7 U.S C. 1010, 1011) authorizes and directs the Secretary of Agriculture to develop a program of land conservation and land utilization to protect the public lands

* *The Wilderness Act of 1964* (16 U.S C 1131, 1132), authorizes the Secretary of Agriculture to take such measures as may be necessary in the control of fire within designated Wilderness

* *The National Forest Management Act of 1976* (16 U S C. 1600) directs the Secretary of Agriculture to specify guidelines for land management plans to ensure protection of forest resources.

* *The Clean Air Act of 1977, as amended,* (42 U.S C 1857) provides for the protection and enhancement of the nation's air resources

Additional authorities provide for Forest Service fire protection activities on other lands under appropriate circumstances

* *The Economy Act of 1932* (41 U S.C. 686) provides for the procurement of materials, supplies, equipment, work, or services from other federal agencies

* *The Granger-Thye Act of 1950* (16 U.S C 572) authorizes expenditure of Forest Service funds to erect buildings, lookout towers, and other structures on land owned by states Provides for the procurement and operation of aerial facilities and services for the protection and management of national forests and other lands administered by the Forest Service.

* *The Reciprocal Fire Protection Act of 1955* (42 U S C 1856) authorizes reciprocal agreements with federal, state, and other wildland fire protection organizations

* *The Wildfire Suppression Assistance Act of 1989* (42 U S C 1856) authorizes the Secretary of Agriculture to enter into agreements with fire organizations of foreign countries for assistance in wildfire protection

INTRODUCTION

Understanding the role fire plays in shaping plant species composition and structure is the critical first step before any fire management options can be addressed Only after determining what role fire played in a given ecosystem can the manager(s) decide if that role is desirable or not, and manage accordingly The following is a brief discussion of the

role of fire within different ecosystems and vegetation types, and the management options or direction that are available

The Role of Fire

That fire's role is significant has been firmly established through many studies and publications (Crane 1992, Washington Office Staffing Paper 1993, Spero 1991, Kilgore 1981, to name a few) It is also supported by the findings and conclusions of the RGNF *Range of Natural Variability* report (See Appendix A)

These sources help determine whether an ecosystem is "fire-maintained" via high-frequency, low-intensity surface fires (e g , ponderosa pine) or "fire-initiated" via low-frequency, high-intensity crown fires (e g , spruce, fir, lodgepole pine) Fire-initiated ecosystems can also be caused by high-frequency, high-intensity crown fires, as in oak or chaparral Fire serves as a stand-replacement event which initiates new vegetative cycles.

As with any classification system, there are exceptions and areas of "overlapping" or transition However, this determination is the first step to typifying the natural role of fire

Fire-Maintained Vegetation

Studies have shown that ponderosa pine and mixed-conifer types are especially sensitive to disruptions in the natural fire cycle Naturally occurring (i e , lightning-caused) fires removed accumulations of litter and other downed material regularly (every 8-30 years) This high frequency kept the fuels on the forest floor form building up, and the fires were generally low-intensity surface events This created a more favorable seedbed for the shade-intolerant ponderosa pine It also thinned out dense clumps of established seedlings and saplings, giving the remaining trees more sunlight, nutrients, and water

The interruption of this natural cycle of fires (i e , by man's suppression of all fires) has had many serious consequences over time The first is a buildup of forest-floor litter and debris in ponderosa pine and Douglas fir/ mixed-conifer As additional time progresses without fire, the more fire-resistant ponderosa pine begins to be replaced by the more shade-tolerant Douglas-fir

Then, as these seedlings and saplings grow denser and taller, they set the stage for serving as "ladders" by which a low-intensity fire can move up from the surface and into the overstory, to become a crown fire This crown fire, combined with the additional soil heating from the burning of the accumulated forest-floor litter, is likely to kill all of the trees and leave little hope for recovery Not only has this type of fire ceased to function as a stand-maintenance event, which is its natural role, but also it has become more resistant to control, costly, and increasingly dangerous to firefighters

Fire-Initiated Vegetation

The wetter, higher-elevation forests of Engelmann spruce and subalpine fir have not been as intensely studied as the lower-elevation, long-needle-pine types with respect to fire effects, so the role of fire is less understood It is known that the time that passes between fires that cover significant acreages (greater than around 1,000 acres) is much longer Current knowledge suggests that 150-400 years between these fires is a legitimate range

(Crane 1982, Fire Effects Information System 1994). These fires, though infrequent, are usually of a much higher intensity and often develop into stand-replacement events

These stand-replacement fires, when they occur from natural causes in this vegetative type (spruce-fir), should not be looked as "catastrophic" events within this ecosystem The fire is functioning as a natural, though very infrequent, event which initiates new vegetation cycles The term "catastrophic" is more appropriate when used to describe large, high-intensity crown fires in the fire-maintained systems described earlier This is because these systems have evolved and adapted to much more frequent and less intense fire disturbance And when the "non-characteristic" crown fire occurs, the systems' ability to recover their pre-fire condition or structure is oftentimes precluded This post-fire or post-disturbance recovery ability is often referred to as an ecosystem's "resiliency "

Management Direction/Options - Use of Prescribed Fire

Though all forested areas will be evaluated for fire and ecosystem needs, priority has been given to locating and mapping fire-maintained ecosystems, and developing treatment needs for those stands most affected by the exclusion of fire The reason for this prioritization is related to the resiliency issue mentioned previously, and is more thoroughly discussed in the Affected Environment section

The first step was a broad-scale look at the Land Type Association map generated by the GIS group, concentrating on the LTA 3, 5, 8, and 9 areas A finer-scale view can be obtained by the relatively straightforward process of pulling site information out of the RMRIS database However, the data retrieved must also extend beyond the boundaries of sites classified as ponderosa pine so that areas once dominated by pine, but now showing Douglas-fir predominant, can be prioritized for evaluation (Refer to Table 3-51)

These identified areas will be further evaluated in order that an effective and efficient treatment program can be developed The degree to which fire suppression has created unnatural litter accumulation and shade-tolerant regeneration will then be quantified When this is done, management options (prescribed burning, timber harvest, grazing, etc) can be developed for creating more natural fuel loadings (a tons-per-acre measure of fuels)

On this Forest the use of prescribed fire for anything other than burning slash piles has been limited Concerns about nutrient recycling will further limit the practice of slash piling

Opportunities do exist to enhance other resource areas (wildlife habitat, silviculture, and recreation) with prescribed fire, both natural and management ignited. Additionally, creation and maintenance of fuel profiles (the representation of all fuels in terms of vertical and horizontal arrangement, amount, and continuity) consistent with historic fire regimes and natural variability could be obtained using prescribed fire

Management Direction/Options - Fire Suppression

Although all wildfires continue to receive an immediate suppression response, the level of the response, in terms of both staffing and expense, may vary through the next 10-15 years The evaluation criteria will consider land and resource management objectives, potential suppression costs versus resource damage, public and firefighter safety, and local, regional, and national reinforcement capabilities

Based on these factors, the Forest has analyzed the various Management-Area Prescriptions, and their associated land values, to arrive at a variety of appropriate suppression responses that may be used after evaluating current and expected conditions. This important concept of "Appropriate Suppression Response" has evolved from a previously rather limited approach to suppressing fire that relied on the strategy of "Confine, Contain, or Control " The more flexible current scheme allows for combinations of the "Three Cs " In effect, this gives the fire manager a less restrictive choice when trying to determine the best match of suppression tactics to land and resource management objectives, costs, and the other criteria mentioned in the previous paragraph

AFFECTED ENVIRONMENT

Historically, in the Forest Service's Rocky Mountain Region, the RGNF has some of the lowest fire-occurrence and fire-acreage rates This is mainly due to the nature of the predominant cover type (spruce-fir) and its associated fire regime This aspect of the "affected environment" will be more thoroughly discussed later in this section

Conditions conducive to high fire intensity do exist, however The Forest normally experiences high winds in the spring and early summer, and if these winds coincide with a dry spell, fire danger can increase significantly

The risk has been unusually high over the past five-year period, because the average annual precipitation has been well below normal In the fall, as the vegetation dries and cures, the danger of a human-caused fire increases (Refer to the RNV study [Appendix A] for the 20-year history of RGNF wildfires [numbers, cause, and acres per year, with 20-year average for each])

It should be noted that we can draw only limited conclusions from the above-mentioned data of 20 years office on the RGNF This is due to the relatively small time interval it represents when used to form conclusions or inferences regarding fire's role in the spruce-fir cover type With return intervals of 150 to 300 years, the 20-year "snapshot" history is a very narrow picture It does, however, have much more validity when addressing lower-elevation, short-return-interval fire regimes

Fuels Management

Any discussion of fire is directly tied to the fuels that support it The following is a brief description of the various types of fuels that affect fire behavior and management.

Surface fuels are the materials lying on or immediately above the ground, including needles, grass, small and large dead wood, duff, and low brush

Aerial fuels are green and dead materials in the middle to upper forest canopy, including tree branches and crowns, snags, moss, and high brush and reproduction

Natural fuels are those surface and aerial fuels that occur naturally through plant growth and mortality

Activity fuels are the surface fuels created by various management activities (i e., logging, thinning, facilities or road construction)—often called "slash"

Fine fuels are generally very small in diameter (grass, needles, small twigs, etc) and contribute to fire spread

Heavy fuels are those larger in diameter (downed logs, snags, large branches) that contribute more to the intensity and duration of a fire

Generally speaking, stands subjected to various harvest techniques contain more activity fuels than the amount of natural fuels in an untreated stand. And though the fuel-*loading* difference between treated and natural stands in the spruce-fir types is often negligible, the difference in the fuel *profile* is what creates the concern

Timber harvest projects in this Landtype Association (LTA 1) account for 80% of the harvest acres and have produced 2,000-3,000 acres annually of new activity fuels Treatment of these acres to reduce the fuel hazard has been by lopping and scattering, piling, burning, and fuelwood removal

Historically, the creation of canopy openings in treated stands has reduced the risk of crown fire, by breaking up aerial-fuel continuity However, recent treatments that remove generally less of the canopy, yet produce surface fuels, leave many stands even more susceptible to crown fire The determination of risk is based on the management allocation and role of natural fire on that particular piece of ground

If timber harvest is the overall management direction, then a more aggressive fuels treatment and fire suppression program is obviously indicated The same would hold true if management direction indicated other values would be threatened by a naturally occurring wildfire (i e , developments or structures)

Conversely, if the risk to timber, structures, or other human-related values is not there, then the crown fire risk would be determined based on whether that type of fire is part of the ecosystems' fire regime (e g , Is it a fire-maintained or fire-initiated system?)

Fire Suppression

The small number of acres burned annually can be attributed to many factors These include an effective prevention program aimed at reducing human-caused ignitions, effective fire readiness, and the fact that most ignitions occur during periods of low to medium fire danger Effective response time, helped by knowledge of the local road system, has also served to reduce the number of escaped fires

The largest factor contributing to the low acreage of wildfires, however, is that nearly 50% of the Forest is found in high-altitude spruce/fir (LTA 1), which is a fire-initiated ecosystem. As stated earlier, the role of fire here is not as well-defined as in the ponderosa pine and mixed-conifer (LTAs 3, 5, 8, and 9), but it is known that these spruce-fir systems do burn as part of their successional pattern, albeit within time spans beyond most managers' "planning horizons " The question is not if they will burn, but when

This 150-400 year cycle of high-intensity fires presents a challenging administrative dilemma Fire management and planning within LTA 1 can be very difficult, due to its apparent "all or nothing" fire characteristic In other words, either ignitions cannot sustain themselves, or they become so large so quickly that current technology and tactics can do little to stop them And therein lies the issue Even if they could be stopped, should they be?

Visual indicators of past intense, stand-replacement burns are found throughout the Forest The west side of the Sangre de Cristo mountains, North Cochetopa Pass, the Creede area, and the Osier Park area are just a few of the more obvious locations of past large fires The Osier burn is of particular note due to its size, which is estimated at more than one million acres Also, the report on the history of early forest fires (1850 to 1920) on lands now in the RGNF (Spero 1991) shows a significant history of large-fire occurrence

Another area of concern, when speaking of the fire suppression program, involves the lower- elevation ponderosa pine and mixed-conifer type forest (LTAs 3, 5, some 8 and 9). These are generally fire-maintained systems that before the influence of organized fire suppression had a short to medium span of time between fires (return interval) Such fires were also relatively low in intensity and served to maintain the system through periodic fuel load reductions and "selective thinning" of shade-tolerant regeneration

The more recent history of full suppression of all fires has upset this schedule in some areas Suppressing all fires has created unnaturally high dead-fuel loadings and areas of dense, shade-tolerant species encroachment When this occurs, the probability of a fire developing from a low-intensity, stand-maintenance-type burn into a high-intensity crown fire is greatly increased The effect of this stand-initiating event in a system evolved under stand-maintenance fires is to almost negate, or at least greatly reduce, the ability of the pre-fire vegetative cover to regenerate With the relatively small amount of fire-maintained ponderosa pine (less than 15%) still established on this Forest, that would be a significant loss

Table 3-51. Relative Fire Hazard of Douglas-Fir and Ponderosa Pine

Structural Stage	Fire Hazard	Douglas-Fir	Ponderosa Pine	Total
3A	Low	4,980	495	5,475
3B	Medium	13,995	420	14,415
3C	High	14,985	0	14,985
4A	Low	27,045	10,900	37,945
4B	Medium	66,670	5,340	72,010
4C	High	31,800	275	32,075
5	High	37,710	20,340	58,050
TOTALS		197,185	37,780	234,955

3 = Trees are 1-5"DBH (seedling/sapling) or 5-9"(pole-sized timber)
4 = Trees are 9"or greater DBH
5 = Trees are 9"or greater DBH and stand is considered late seral

A = Crown cover 0-40%
B = Crown cover 41-70%
C = Crown cover 71-100%

(Code 5 is always a crown cover of 71-100%)

The first step in identifying these potential problem areas was the development of Table 3-51 Structural stage and species were the parameters chosen to reflect the concerns mentioned above The structural stage code consists of a

number representing the diameter at breast height (DBH) for most of the trees, and a letter representing the crown cover percent Note that the "Fire Hazard" designation is reflecting the potential for a non-characteristic crown fire event, *not* the probability of a fire occurring in the first place.

Though these LTAs (3, 5, some portions of 8 and 9) occupy a small percentage of the Forest (about 13%), the effects of interrupting the natural fire cycle occur much faster and to a greater degree than in other LTAs Priority for evaluation and treatment should be given to sites within these LTAs In some areas the fuel loading has reached a point that precludes the application of fire, both natural and management- ignited, until steps have been taken to return the fuels gradually to a more natural state, which is often the desired condition When this condition has been reached, reintroduction of fire into the system would be greatly enhanced

Range of Natural Variability Conclusions

* Climatic factors can be correlated with major fire events with more certainty than can human-influence factors, particularly in the spruce/fir cover type

* The fire regime of the predominant cover type (>50% Engelmann spruce/subalpine fir) was altered by humans during initial settlement The alteration was of the fire regime frequency rather than the extent (size) or intensity of the fires.

* Lower-elevation mixed-conifer and ponderosa pine sites (about 13% of the Forest) have been affected by suppression of natural fires, which allowed shade-tolerant species to supplant naturally occurring fire-resistant species and also created unnatural fuel buildup.

* The Engelmann spruce/subalpine fir cover type exhibits some of the most variable and slow successional trends, many 100--150-year-old burns are not showing conifer or aspen reestablishment, and still maintain a grass or shrub cover

* In the lower-elevation sites, interruption of the natural fire regime by fire suppression had a more immediate impact on site composition than in upper-elevation sites

ENVIRONMENTAL CONSEQUENCES

The following description of effects assumes that funding and budget levels will be consistent with recent levels on the RGNF The first section will address effects and/or fire program actions that will be common to all Alternatives

Effects Common to All Alternatives

Fire Management Budget

The suppression-program organization and allocated dollars are based on the National Fire Management Analysis System (NFMAS) This process uses past fire history and suppression costs to arrive at an organizational/budget level that most efficiently manages wildfire, commensurate with the values at risk (timber, structures, watersheds, soils, etc), and is called the Most Efficient Level or MEL

One limitation of the NFMAS process has been identified when addressing fire program needs in a spruce-fir-dominated forest This limitation is due to the fact that NFMAS uses recent fire history and costs (over the past ten to 20 years) for analysis As mentioned earlier, this is a relatively minuscule time frame when looking at potential wildfire acreage in the spruce-fir habitat, due to the long return intervals involved

NFMAS could develop projected fire program costs per Alternative, but the historical fire occurrence and acreage burned are so low on this Forest, and the current budget level so small, that the time and effort spent analyzing the different effects would not merit the small change in the fire budget that would be evident

This suggests that the organization and budget for fire suppression that are currently in place will remain throughout the planning period, whatever Alternative is chosen Some fluctuation in dollars available is expected, but this cannot be accurately predicted

Occurrence and Acreage Burned by Wildfire

Prediction of wildfire acreage burned, by Alternative, would be an exercise in "best guessing " The seasonal-weather and fuel variables, combined with organization/budget constraints, would make any predictions very generic and without data or research to support them And, as noted several times previously, the 20-year fire-history data regarding acreage are of limited use in the spruce-fir type, because they do not give an accurate portrayal of the potential for very large fires in this type This is once again due to the narrow time span represented, relative to the time span involved in spruce-fir stand-initiation events

Comparisons can be made as to the relative increase or decrease in potential wildfire acreage per Alternative, but no actual numbers are assigned The effects of other resource programs on fire suppression will identify trends or potential effects, but cannot assign percentage or acreage-increase/decrease numbers This is due not only to the situations previously described, but also to the fact that many other resource program effects are potentially both negative and positive, when speaking of wildfire acreage.

As for wildfire occurrence, since the majority of fires on the Forest are lightning-caused, and there are no methods for predicting lightning occurrence on a yearly or per decade basis, the actual number of wildfires should remain within the historic range(the past 20 years) (Refer to Table A-5 in Appendix A)

Acreage of Management-Ignited Fire for Natural Fuels Treatment

The acres targeted for natural fuel treatment with management-ignited fire are based on the data in Table 3-51, and will be relatively unaffected by the Alternative chosen The total acres of ponderosa pine (37,770) divided by the range of fire-return intervals for this species (8-30 years) will give a very rough estimate of the target acreage per year that should have natural fuel treatments applied, despite the Alternative chosen. Ponderosa pine was chosen because it is the species most dependent on fire, for this Forest, and has been the most dramatically affected by the exclusion of fire

37,770 acres
8 yrs = about 4,700 acres per year (high end)

37,770 acres
30 yrs = about 1,200 acres per year (low end)

Factoring in the prescribed-fire planning and implementation expertise currently on-Forest, and the economics involved, the 4,700 acres/year figure is probably unrealistic until very late in the planning period Therefore a reasonable projection of MIF acreage for natural fuel treatment under all Alternatives is 1,200 to 3,000 acres per year

Effects Compared between Alternatives

Effects on Fire from Timber Management

Timber harvest creates additional areas of activity fuel buildup and increases the potential for fire starts from chainsaws, heavy equipment, smoking, etc If not treated through Brush Disposal (BD) programs, wildfire suppression crews will be exposed to additional hazards when dealing with fires in or next to these areas This is due to the increased fire intensity and resistance to control

Conversely, the additional road access to these sale areas can improve response times and increase effectiveness of engines, water tenders, etc. Timber harvest activities that create large canopy openings can also reduce the potential for fires that move through the crowns of the trees, independent of the surface fuels

Thus the fire management program can be affected in both a negative and a positive manner by timber harvest The increased activity fuels created will obviously increase the need for effective slash disposal programs via BD. However, as Forestwide Objective 2 10 states, various timber harvesting techniques (pre-commercial and commercial thinning, fuelwood, etc) can be valid tools for reaching desired fuel loads where natural fuel loading is excessive, or in sites identified for fuel breaks or hazard reduction

In Alternatives A and F, timber harvesting is expected to be low Any commodity production will be the function of other activities and will fluctuate from year to year

This will affect the fire suppression program in two ways First, there will be less access to many areas, which may increase report and response times, which subsequently could allow

fires to increase in size and intensity before the initial attack forces arrive Second, the risk of crown fires will increase, due to the reduction of canopy openings created and ladder fuels removed by harvest activities. These are not necessarily negative impacts, however If the type of fire is within the natural role for that system, and there are no resources at risk (i e , timber sale areas), then it would be considered a desirable event and managed accordingly (That is, assuming it were a natural ignition)

The activity fuels created from timber harvest will obviously be greatly reduced This will lessen the number of areas considered high-hazard, due to activity fuel loads, that wildfire suppression crews must consider and deal with The potential for person- and equipment-caused fires associated with harvest activities (chainsaws, skidders, smoking, etc) will also decrease

Due to the great reduction in activity fuels created, the fire management program will necessarily direct its emphasis from activity-fuel to natural-fuel management This is related to Management Area allocations, and for Alternatives A and E, will be addressed in the Recreation Program effects section In Alternative F, the Core Area allocation creates this shift in program emphasis from activity fuels management to natural fuels

Alternative B, and to a lesser degree Alternatives D and G, will have the opposite effects of those listed above Access to many areas will improve, crown densities will decrease, and ladder fuels will be reduced in harvest activity areas Also, there will be more constraints on the implementation of Prescribed Natural Fire plans, due to the increase in areas which would need protection of timber resources from fire

Of course, activity fuels and their associated hazards will require additional mitigation measures, usually addressed through an aggressive BD and KV program

Effects on Fire from Recreation Management

Developed- and dispersed-recreation programs can affect the fire suppression program both positively and negatively. Heavy dispersed use increases the potential for person-caused fires and, depending on how "dispersed" they are, report and response times could increase, allowing fires to increase in size and intensity On the other hand, more people will be in the woods to report fires Developed recreation sites are seldom a problem in terms of fire starts

The fuels management program is most directly affected by the developed sites These sites need to have fuel-reduction techniques applied in and around them, to protect the users and the structures or improvements that exist there

Wilderness and semi-primitive nonmotorized areas are more conducive to doing natural fuels treatment using prescribed natural and management-ignited fire (PNF & MIF). This is due to relative lack of structures, improvements, and other tangible values that might be at risk The size of these areas (contiguous) is usually the deciding factor in whether (PNF or MIF) is used PNFs require considerably more acreage to be safely and efficiently carried out

Under Alternatives A and F, the allocation of many areas as Recommended for Wilderness (A) or Core Area (F), plus the emphasis on semi-primitive nonmotorized recreation in other

locations, will affect the fire program mainly via response time and access impacts But as discussed in the Timber Effects section, those impacts are not entirely negative.

Since these same areas will have less resources identified as at risk from wildfire (i e , fire performing its natural role is desirable), the PNF plans could be more fully implemented. Also, the Appropriate Suppression Response of Confine or Contain, rather than Control, could be used more effectively These Confine or Contain designations will allow more flexibility in deciding suppression objectives In other words, the use of the Control response, which emphasizes keeping the fire as small as possible, will not be as universally applied Larger fire sizes are accepted, once a Confine or Contain strategy is chosen

Also under Alternatives A and F, the increase in undeveloped, dispersed recreation areas, and its associated lack of improvements/structures, will affect the fuels management program in various direct and indirect ways. The opportunities for developing PNF plans should increase, if certain other constraints are recognized (i e , size of adjacent area, amount of hazardous fuel loading, values at risk in or next to the PNF area, etc) The use of MIF for natural fuel treatment should be relatively unaffected by the recreation emphasis allocations, except for some potential to create logistical/support problems This would be mainly due to engine and other equipment access needs and the additional time/effort needed for preconstructed firelines or fuelbreaks

Alternative E has the potential to create more developed recreation sites and will most directly affect the fuels management program due to structure and improvement protection needs There is also the potential to increase human-caused fires, due to the possible increase in Forest visitors The recreation program effects under Alternative D will be less significant than in A, E, and F Alternative B recreation program impacts should be minor

Effects on the Fire Suppression/Fuels Mgmt Program from Wildlife Management

Wildlife management programs have little effect on the fire suppression program The biggest impact is on the fuels program, due to the frequent use of prescribed fire for various habitat improvement projects, such as forage rejuvenation, sighting-distance needs, etc

Alternatives A and F, and to a lesser degree Alternative E, have the potential to open more areas for wildlife habitat improvement projects, mainly due to the emphasis on wildlife needs over domestic livestock If meeting the habitat-improvement objectives can be facilitated by using prescribed fire, then the acreage of land treated by fire, besides fuel treatment acres, will increase This increase cannot be figured out until a wildlife/livestock conflict arises, and it is decided that fire is a viable tool for project accomplishment Wildlife management effects on the fire program under Alternatives B and D will be insignificant

Effects on the Fire Suppression/Fuels Mgmt Program from Heritage Resources (HRs)

The fire suppression program can be effected by HRs where sites currently eligible for or listed on the NRHP need special protection measures If the site is within the fire perimeter or located along control lines, this needs to be communicated to the fireline personnel, and

appropriate line construction and extinguishment/mop-up constraints established This will reduce or eliminate potential site degradation from suppression activities If these established HR sites are threatened by a fire, the need to protect it could limit the suppression response to control, rather than confine or contain

The fuels management program is affected by HRs in that all areas proposed for prescribed burning for fuel reduction must have HR inventories done before ignition If sites have already been identified within the burn unit, then appropriate mitigation measures must be carried out (avoidance, isolation, low intensity fire, etc)

Under Alternatives A and F, the increase in potential PNF areas would create a need for HR surveys in these sites Management-Ignited Fire acreage for natural fuel reduction should not change (refer to the "Effects Common to All Alternatives" section)

CUMULATIVE IMPACTS

In Alternatives A and F, timber harvesting is expected to be low Any commodity production will be the function of other activities, and will fluctuate from year to year This will affect the fire suppression program in two ways First, there will be less access to many areas, which may increase report and response times, which subsequently could allow fires to increase in size and intensity before the initial attack forces arrive. Second, the risk of crown fires will increase, due to the reduction of canopy openings and ladder fuels removed by harvest activities

Due to the greater reduction in activity fuels created, the fuels management program will be forced to direct its emphasis from activity fuel to natural fuel management This is related to Management Area allocations

Developed and dispersed-recreation programs can also affect the suppression program Heavy dispersed use increases the potential for person-caused fires and, depending on how "dispersed" they are, report and response times could increase, allowing fires to increase in size and intensity before initial attack forces arrive

Another area that will affect the fuels and suppression program is the increase in rural development in areas bordering the National Forest As more development occurs, emphasis will be needed on reducing hazard fuels next to developments

WILDLIFE

ABSTRACT

The Endangered Species Act and the species viability regulation (36 CFR 219 19), refer to the Species Viability section of this EIS for more information) provide a basis for the Forest Service's wildlife management, in addition, the RGNF has a cooperative relationship with the Colorado Division of Wildlife (DOW) While both agencies have a common goal of wildlife management, there are separate responsibilities. The DOW is charged with managing the state's wildlife populations, the RGNF's responsibility is to manage the habitat.

The focus for the analysis is on the habitat for neotropical migrant birds in the spruce-fir forests, elk, bighorn sheep, and moose The spruce-fir neotropical migrant birds were chosen because they are in the forest cover type where the most potential timber harvest could occur Elk, bighorn, and moose were chosen because of the high public interest in both hunting and viewing them There will be limited impacts on these species because of the small amounts of timber harvesting, oil and gas exploration, and road building, and the use of resource protection measures

INTRODUCTION

Legal Framework

The *Endangered Species Act* and the *National Forest Management Act* provide a basis for the Forest Service's wildlife management, in addition, the RGNF has a cooperative relationship with the DO) While both agencies have a common goal of wildlife management, there are separate responsibilities The DOW is charged with managing the state's wildlife populations, the RGNF's responsibility is to manage the habitat.

Wildlife

The Forest's variety of habitats supports about

* 196 species of birds,
* 69 species of mammals,
* 15 species of amphibians/reptiles, and
* 9 species of fish

Of these species, the DOW has population estimates for four game species The estimates are based on game management boundaries that include lands other than National Forest For comparison, the DOW herd objectives for those species and the 1985 Plan's numeric goal for elk and deer are given in Table 3-52 Population estimates for non-game species do not exist at this time.

Table 3-52. Big Game Populations

SPECIES	1994 POPULATIONS	DOW's HERD OBJECTIVES	1985 PLAN GOAL
Elk	13,950	12,350	12,200
Deer	19,580	17,150	8,200
Bighorn Sheep	1,300	1,300	No Goal
Moose	125	350	No Goal

Non-Game Species

Most of the species that occur on the Forest are not hunted, fished, or trapped, and are known as non-game (e g., woodpeckers, snakes, and chipmunks) Except occurrence data, little is known about population sizes or trends

An emerging issue that has arisen since the 1985 Forest Plan concerns the status of forest-dwelling birds that summer in the U S but spend all or part of their winter in Central America These birds are known as neotropical migrants The concern is that many of these species appear to have experienced population declines in many areas of the U S Possible explanations for the population declines include forest fragmentation on the breeding grounds, deforestation of wintering habitats, pesticide poisoning or the cumulative effects of habitat changes (Finch 1991)

To date, there is not enough evidence to assess the status of the migrants that occur in the Western United States Terborgh (1989) points out that because Western migrants reside primarily in riparian and montane forest habitats that are restricted in distribution, total populations of Western migrants may be much smaller than those of Eastern species, making them particularly vulnerable to disturbance

To help determine the population trend on the Forest, two breeding-bird survey routes have been established on the Divide Ranger District These routes are part of a network of routes scattered throughout the United States The routes provide information on the number and types of birds present during the breeding season The results are aggregated and give a picture of the trends with respect to numbers of birds and species mix The Forest's transects are too new to give any trend data

Of the known bird species on the Forest, 51%, or 101 species, can be identified as neotropical migrants These include such species as common night hawk, rufous hummingbird, barn swallow, mountain bluebird, and American goldfinch (A list of these species is on file at the RGNF office in Monte Vista)

In 1994, a cooperative project between the Forest, Colorado Bird Observatory, and DOW was undertaken to assess the relationship between neotropical migrant bird occurrence and unlogged spruce-fir forest patch size, patch shape, and structural class. In 1995, three other studies were started (1) one of mixed-conifer, similar to the spruce-fir project, (2) an analysis of the potential impacts of a recent timber sale that used group-selection harvest

methods, (3) an evaluation of the numeric response of birds to an infestation of the western spruce budworm

Game Species

The most sought-after big-game species on the Forest are elk and mule deer Both species spend their summers throughout the high country. There are roughly 1.5 million acres of summer range Summer range consists of the following Landtype Associations (LTAs) Engelmann Spruce, Aspen, Douglas-fir, Alpine, Thurber Fescue and Sedges There is ample forage available for the existing populations. (See the Range section for further discussion)

As winter approaches, the animals move down in elevation, with deer tending to winter at lower elevations than elk There are some 300,000 acres of winter range Winter range consists of the following LTAs. Ponderosa Pine, Pinyon, Gambel Oak, Arizona Fescue, and Western Wheatgrass The winter range is bunch grass dominated with isolated pockets of mountain mahogany, winter fat, and oak browse

There are three characteristics of a grass-dominated winter range First, this type of range favors elk over deer because "elk appear to be nutritionally better suited for herbaceous-vegetated winter range rather than browse-vegetated winter range" (Thomas and Toweill 1982 363)

Second, research done by DOW in the mid 1960s found that the elk on grass-dominated winter range were smaller and less productive, compared with those that wintered on browse ranges (R. Boyd personal communication) The suspected difference in body size was the fact that the animals were not getting the same quantity of protein Protein is considered the most important nutrient, essential for body maintenance, growth, and reproduction. The animals receive their protein primarily from shrubs, willows, aspen, and any new grass shoots that may appear

Third, because of the smaller sizes, the animals are more susceptible to winter die-offs than their browse-range counterparts While no research was done, it is reasonable to suspect the same body-weight-to-browse relationship for deer

A cooperative project between the Forest, Bureau of Land Management, and DOW to inventory winter range was conducted over a three-year period (1993-95) A total of 100,770 acres was inventoried The four objectives were to determine (1) condition, (2) trend, (3) forage use by grazing ungulates, and (4) if there was a difference between areas grazed only b y elk and those grazed by both elk and livestock The Forest Service's Rocky Mountain Region's *Rangeland Analysis and Management Training Guide* was used to help in the project's design and implementation

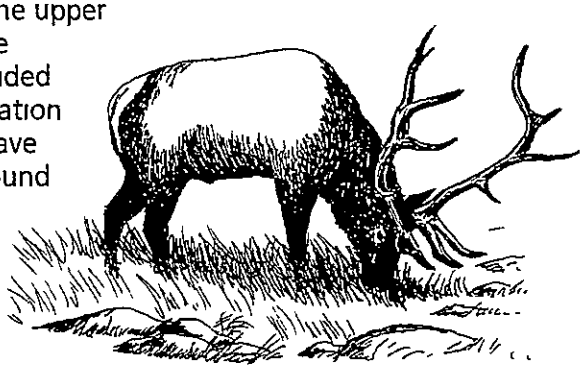
The Forest and DOW have pursued an aggressive bighorn-sheep transplant program since the 1950s. The result has been successful, with the population growing steadily since its low of the early 1900s (RNV Report) There are now established herds on every Ranger District

Some of the larger herds are near Natural Arch, Trickle Mountain, Conejos Canyon, and the Sangre de Cristo Mountains There have been episodes of high mortality for some of the herds. In discussions with Dave Kenvin (DOW Monte Vista Terrestrial Biologist), the episodes have occurred in Alamosa Canyon (1990), Blue Creek (1993), La Garita (1993+), and Trickle Mountain (1994+)

In the case of Alamosa Canyon and Blue Creek, the suspected cause is interaction with domestic sheep, which resulted in the bighorns contracting pneumonia There is doubt about the cause in the other two areas, since they have been having problems with lamb survival for the past couple of years

Symonds and Singer (in prep) found the persistence of the transplanted populations was negatively correlated with proximity to domestic sheep. They recommended that a buffer of at least ten miles and preferably 20 miles, be maintained between bighorns and domestic sheep, except where barriers (e g , large rivers, highways, etc) separate the two species

Between 1990 and 1993, 100 moose were transplanted to the Divide Ranger District from herds in northern Colorado and Utah The upper Rio Grande River was chosen because the amount and distribution of willows provided the habitat necessary to support a population of moose While moose are known to have lived in Colorado, no records could be found of them having been documented on the Forest (RNV report) A verbal account of moose antlers collected by a hiker in willow habitat near the confluence of Snowslide Creek and the Los Pinos River in the early 1980s is the only known record in the Creede vicinity



AFFECTED ENVIRONMENT

The focus of this analysis will be on the habitat for

* neotropical birds in the spruce-fir forests,
* elk,
* bighorn sheep, and
* *moose*

Spruce-fir neotropical migrant birds were chosen because they are in the forest cover type where the most potential timber harvest could occur Elk, bighorn, and moose were chosen because of the high public interest in both hunting and viewing them

The spruce-fir landscape study revealed that the most important habitat attribute was structural class, with species abundance and richness increasing across the classes, meaning the highest values were obtained for those forests considered late-successional (Carter 1995) There was no great difference in the bird community between classes from a simple numeric perspective But since there are relatively few species in the spruce-fir, the difference by a percentage of species is proportionally large Interestingly, this is the same relationship found in the mixed-conifer study (Gillihan and Carter 1996a)

Although Carter conducted over 1,000 point counts scattered across the Forest, he did not find many woodpeckers At first glance this appears odd, given that there was a large amount of snags available However, Carter cites two studies which spoke to the apparent affinity some woodpeckers (downy, hairy, three-toed, and northern flicker) had to recently burned areas, and surmises that woodpeckers are rare in spruce-fir forests unaffected by fire

There was a suspicion that the woodpeckers might also respond to a spruce budworm outbreak Gillihan and Carter (1996b) did not find that to be the case in their study of a budworm outbreak on the Saguache Ranger District From the literature, they found that woodpeckers seem to respond to the bark beetles that sometimes follow a budworm infestation

The Forest's wildlife biologists and range conservationists feel that most of the big-game summer range is in good to excellent condition, with a static trend The reasons are the apparent vegetative productivity, plant vigor, and species composition

Recently there have been concerns about forage competition between elk and domestic livestock on some range allotments To date there have been limited data gathered to address this issue The data that have been gathered suggest this is more of a timing issue, especially when there is a late snowmelt and the elk are moving through an allotment just ahead of the livestock By the time the livestock go on, there can have been enough use by the elk to exceed the utilization standards In most years the delay between the time the elk go through and the livestock arrive allows for enough regrowth to avoid the problem

To begin to address these and other big-game conflicts, the DOW has initiated the Habitat Partnership Program, which works to resolve such conflicts The program has recognized the need for more data to determine the extent of the elk/livestock forage conflict, and will be gathering the necessary information in the next few years A offshoot of this effort is that the DOW will be reassessing the herd objectives for the area, and will be soliciting public input to determine the new objectives

Winter-Range Study

The results of the winter-range study are briefly summarized below

Condition

The various winter-range areas were broken out by their vegetative capability in what are known as Plant Associations (PAs) The PAs were grouped into one of three Data Analysis Units (DAUs) DAUs portray approximate boundaries of big-game herds, and are the basis DOW uses to manage them

With a couple of exceptions, a particular PA was found in more than one of the DAUs Eighteen PA/DAU combinations were selected for analysis Each of these was then sampled with ten transects, to determine species composition and frequency. For each PA, an area was selected that represented the desired composition and frequency To determine condition, the values of the PA were compared to those of the site with the desired values. The higher the similarity to the desired site, the better the condition of the range These similarity values were then placed into one of two categories satisfactory (>65% similarity) or unsatisfactory (<65% similarity)

The Pinyon Pine/Blue Grama PA was the largest PA sampled (32,760 acres), and it was found in all three DAUs A problem was discovered when trying to develop an appropriate set of desired site values this PA encompassed a wide range of elevation As a result, more than one desired site was needed, but there was not enough time in the study to select more Therefore, the condition rating for this PA was inaccurate and should be dropped from further consideration until the appropriate desired sites can be inventoried Dropping this PA leaves a total of 68,010 acres of winter range and 15 PA/DAU combinations on which to do analysis

The similarity values of the 15 areas ranged from 32% to 69%, with about 5,500 acres (8%) considered in satisfactory condition These results confirm the observations and professional judgements that the lower ranges of the Forest were in poorer condition because of the historic heavy use by livestock

The results must be considered preliminary, however, since they are based on limited transects Other transects will be added as a result of the range analysis associated with implementation of Allotment Management Plans

Trend

While it is very helpful to have an idea as to the condition of the range, the key piece of information is the range's trend To try to obtain these kinds of data, existing trend transects were re-read

A couple of problems surfaced during the study First, it was impossible at times to find the locations of the old transects Second, the technique used with the old transects (Parker Three-Step) was different than the technique used in this study

To overcome this difference, we converted the data from a frequency to a cover measurement While this means a precise measurement could not be made, it still yielded a relative value that showed a general trend

Only those transects with more than two readings were considered We felt that with only two sampling times, there was no way of knowing if the trend was up or down, since the two points could represent a peak or valley in the overall trend line Using this criterion, five transects were re-read Of these, four were located on the Saguache Ranger District and one was on the Divide Ranger District

Of the Saguache transects, two showed an upward trend and two a downward trend The Divide transect showed an upward trend Given that three of the transects were up and

two down, there is no clear indication as to the trend. Because only five transects were read, it is not possible to extrapolate the results to the other portions of the winter range

Other transects will be added as a result of the range analysis associated with implementation of Allotment Management Plans Additional reading will not be conducted until later in the planning period, however, since it is desirable to have five to ten years between readings

Ungulate Forage Utilization

Because of weather and timing, we were unable to gather any adequate utilization data Instead, a series of elk-pellet group counts was run in 1993 and again in 1994 The results were lumped into the general geographic area of the samples, rather than in a particular PA, and placed in one of the following use categories

1993 - 6 light (<20 elk-days/ac) and 5 moderate (20-40 days/ac)
1994 - 11 light and 2 moderate

This suggests that the elk are generally spread out over the range, with a few isolated spots of concentrated use

Difference Between Ranges

One PA with areas grazed by elk only, and others grazed by elk and livestock, had similarity values of 54% and 55% respectively One PA that had not been grazed by livestock for about ten years had a similarity value of 64% Another PA which did have livestock grazing had a similarity value of 66%

This indicates that the presence or absence of grazing per se may be only a minor variable in the resulting condition of a particular area Probably of more influence is how the livestock are managed in a area

Due to concerns that moose might adversely affect riparian habitat, especially in areas already used by domestic livestock, monitoring was begun in the fall of 1992 The plan was to select some areas that had only moose, and others with moose and livestock

We decided to try to use a modified browse technique that would yield the percentage of use on willows The premise is that by measuring the lengths of twigs at various times, the difference in lengths equals the amount of use on that plant Radio telemetry helped locate which riparian areas were used the most

Five willow transects were established, two in areas of moose use only The first transect measurements were taken in the fall of 1993, and have been continued through the spring and fall of 1994 Percent or frequency of use for all willow species along the transects was 29% over the '93-'94 winter, while percent of utilization or amount of use was 51% over the same period

These numbers are based on observations and data collected from a very small representative sample of willows, and appear extremely high when compared to the

photographs taken along the transects These photos suggest that moose use of willows through the fall of '94 was probably slight (less than 20%)

Because of the concerns raised as to the accuracy of the modified browse-transect monitoring method, only photo points will be used until the concerns can be addressed. The photos were retaken in the spring of 1996, and they continue to show very light use on the willows

The DOW has been monitoring reproductive success of moose for the past two years, and has found the success to be quite good -- so much so that they anticipate reaching their herd objective sooner than expected

Range of Natural Variability Conclusions

* The population of ungulates is much lower today than historic literature indicates it was in the 1800s

* The large carnivores have been greatly reduced

* The native fish have been greatly reduced

RESOURCE PROTECTION MEASURES

Numerous protection measures were developed for the proposed Alternatives They are found primarily within the Standards and Guidelines Some of the most important ones are summarized here

* A variety of habitat attributes will be protected with the application of the spatial guideline described in the Fragmentation/Connectivity section Implementation will lead to a mosaic of vegetative composition and structure that is assumed to represent a "natural" landscape The result will be the maintenance of habitat for a variety of species across the landscape

  For example, implementing this guideline replaces having to specify a particular thermal-cover requirement for big game The reason is that conditions that make up thermal cover would be taken care of by mimicking the "natural" landscape

* Hiding cover would be ensured by the Standard that requires leaving enough vegetation along roads to help reduce vehicular harassment

* Potential habitat for cavity nesters will be addressed by implementing the Standard to leave a minimum number (or more) of snags, and also enough replacement live trees to ensure the minimum snag density through time

Unforested and riparian habitats will be protected primarily by two Standards.

* Use of the grazing Standard would continue the practice of linking the amount of grazing use with the condition of the range The premise is that the poorer the range

condition, the lighter the grazing use The result would be the continued improvement of the Forest's rangelands.

* The second standard defines the appropriate stubble height that should be present at the end of the growing season There is the option to increase these stubble height requirements if there is reason to believe that in doing so, a particular habitat objective would be reached

  By restricting the amount of herbaceous forage that can be grazed, there would be a concurrent restriction of the amount of woody vegetation that would be grazed The result would be to reduce the amount of grazing that is currently occurring on the woody vegetation This should allow an increase in woody vegetation in those riparian areas that can support that type of vegetation Consequently, there would be an increase in the condition of the riparian habitat

There are two Management Prescriptions that focus on activities that benefit particular species

* The first Prescription is winter range, and will be applied in the lower elevations of the Forest The intent is to keep the level of human disturbance low, since the animals using the areas are under a great deal of environmental stress For example, oil and gas leases would be subjected to a timing limitation so that there will be no exploration activities during the critical winter months

* The second Prescription is centered on the known bighorn sheep herds on the Forest The intent is to improve the habitat conditions to ensure healthy sheep populations For example, an attempt will be made to create a buffer around the herds in which there would be no domestic sheep. To accomplish that, the currently vacant domestic sheep allotments will be looked at to see if the domestic sheep in the buffer areas can be moved

ENVIRONMENTAL CONSEQUENCES

Effects Common to All Alternatives

ELK/DEER

As can be seen in Figures 3-30 and 3-31 and Tables 3-28 and 3-29, during hunting there is a noticeable increase in activity and road densities The result is a certain degree of displacement from the habitats near the areas of concentrated use But as evidenced by the population numbers for the Forest, there does not appear to be any large-scale impact on either species

There should be an improvement in winter-range condition as a result of a variety of factors First, much of the area is within the Deer and Elk Winter Range Management Prescription (5 41), which emphasize managing the habitat for the needs of wintering big game Second, the premise behind the allowable-utilization levels employed in the Allotment Management Plans is that the poorer the condition, the lighter the use Third, the vast majority of the allotments have some sort of rest or growing-season deferment for

their pastures And fourth, there is no reason to expect the elk to change their distribution patterns dramatically This will mean continued widespread use, but only isolated areas of concentrated use, so that the overall utilization by elk should remain light

The current elk/deer populations show that the Forest has habitat to support numbers beyond the DOW herd objectives Cumulatively, given the small amount of potential habitat that might be disturbed in the planning period, it is highly doubtful there would not be enough habitat to sustain the herd objectives

Moose

Regardless of the Alternative chosen, the Forest will provide enough habitat to meet the herd objective for moose

There is a question about the impact another exotic ungulate might have on riparian systems The worst case would be that the extra use would prove to be too much, and the systems would start to unravel The best case would be that the systems would be able to absorb the extra use without any detrimental impacts

Based on the preliminary results of the willow monitoring, it does not appear the presence of moose will cause a decline in willow health The fact that moose very rarely concentrate in numbers helps keep their grazing impacts at a low level As a result, improvement of riparian habitats should not depend on the absence of moose If the monitoring photos begin to indicate future problems, the Forest will consult with the DOW on how best to resolve the problem Cumalatively, implementation of the Riparian Standards and Guidelines will improve the habitat for moose

Bighorn Sheep

All of the known bighorn herds will be covered by a special Management Prescription that will direct activities to improve habitat conditions for this species The cumulative impact is that the Forest will continue to provide enough potential habitat to sustain the herd objectives for bighorn sheep, in all Alternatives

Spruce-Fir Neotropical Migrant Birds

The conclusion reached by Carter (1995) about the overriding importance of habitat structure has been supported by other studies Many of them looked at situations where timber harvesting radically altered the stand's structure

Franzreb and Ohmart (1978) found an adverse impact on bird composition and densities when 84% of a stand's basal area was removed with a moderately heavy overstory removal Eighty percent removal of basal area also was found to change species composition (Medin 1985)

Hutto et al (1993) located 18 studies (mostly of clearcuts) that had been done in the Rocky Mountains, and found that 12 species were always less abundant in clearcuts than in uncut forests, but were not always so in partially cut forests Brown creeper abundance was consistently lower between harvested and unharvested sites Conversely, ten species were always more abundant in partially logged or clearcut stands

Thompson (1994) detected impacts from ski runs on species composition in lodgepole pine and spruce-fir habitats In each case the control plots were about twice as forested as the treated plots, so that there was a major difference in the structure between the two plots

Some studies have looked at uneven-aged timber harvests, which leave a stand's structure fairly intact Keller and Anderson (1992) looked at narrow stripcuts and spotcuts (1- to 3-hectare clearcuts) and felt that the differences they found in bird occurrence from the different kinds of cutting seemed to be due to the loss of structure, rather than the increase in forest edge or loss of forest interior

Scott and Gottfried (1983) found that ½- to 3-acre clearcuts and individual-tree selection which removed 24-34% of a stand's basal area resulted in only minor changes in bird populations This is even heavier than the types of uneven-aged-management harvests that would be done on the Forest

Gillihan and Carter (1996c) studied a typical example of an uneven-aged-timber harvest on the Divide District This particular harvest was done with group selection, and removed about 20% of the stand's basal area Of the nine species studied, only two of them showed a significant response to the logging, and it was a positive response Of special note is the lack of response by mountain chickadees and brown creepers Other studies have indicated these species generally respond negatively to logging However, a common theme from many of the other studies is that they looked at harvests which removed large amounts of the basal area (e g , clearcutting, overstory removal) and appreciably changed the structure of the stand In this instance the light logging still left enough snags to meet the needs of the chickadee, and enough large trees to meet the needs of the creeper What is still unknown is just what the threshold values are for those particular components of the habitat

As discussed in the TES Animal/Viability section, the current snag density in the spruce-fir exceeds the 100% potential-population level for primary cavity nesters, and also exceeds the density stated for secondary cavity nesters Implementation of the snag standard in timber harvest areas, combined with the high snag densities found in the undeveloped areas on the Forest, will result in a snag density that will still exceed the 100% potential-population level. In addition, with so many acres undergoing natural processes, fire will be able to play out its role, in many cases resulting in constantly created fire-killed trees for those woodpeckers that seek them out

Hutto et al (1993) wrote management guidelines that addressed the needs of non-game species, particularly neotropical migrants. It is of interest to see how closely these guidelines are matched

* "Manage for desired landscape patterns, including the juxtaposition and proportions of cover types "

  This is what the process described by Erhard et al (1996) is built on

* "Manage for the maintenance of natural disturbance regimes Work to ensure that processes like fire, insect outbreaks, and blowdowns are viewed as natural events and strive to maintain those processes "

Scattered throughout this EIS are numerous references to the vital role the natural disturbance processes play, and why they are important to maintain With the large acreage of the Forest in a undeveloped condition, the natural processes will predominate As mentioned, the lower elevations are the most impacted from an interruption of these disturbance processes The intent is to return fire to these areas and begin to make it part of the system once again

* "Use knowledge of the local ecology be cautious about extrapolating results from other areas "

  The Forest is constantly trying to gather local data This can be seen in the various sections of this EIS which bring to light the local research that has been conducted Some examples include the studies of winter range and neotropical migrant birds mentioned above, the collection of reference-stream data for riparian areas, and determinations of soil compaction from harvest activities The Monitoring Plan shows the Forest's commitment to continue to gather specific information for a number of resources.

* "Move towards multi-species management There will always be 'winners' and 'losers' when any management is being conducted The key is to have enough variety in the constantly shifting mosaic of successional stages such that all native species are provided for across the landscape "

  Having a target landscape developed (the reference areas) allows us to put into context the impacts of the proposed activity An integral part of this is gaining knowledge about the habitat needs of species As explained in #3, the Forest is committed to doing what it can

* "Use single-species management only when necessary "

  This is a given with the management direction to ensure that TES species are not adversely impacted

* "Monitor both landscape patterns and species populations "

  As shown in the Monitoring Plan, we have committed to do both.

As discussed in the Fragmentation/Connectivity and TES Animal/Viability sections, there will be very little change in the current amount of late-successional forests or those acres considered undeveloped. The resulting Forest will still be one largely characterized by having ample late-successional forests (approaching biological maximums), with the majority at a low risk of being subjected to human disturbances

Cumulatively there would be no major change in the current make-up of forest structure as a result of human activities, and natural processes will dominate large acreages of the Forest Conservatively, there will be a limited impact on the neotropical migrant birds associated with the RGNF's spruce-fir forests

AQUATIC RESOURCES

ABSTRACT

Water quality is excellent across most of the Forest Sediment is the pollutant of most concern, roads are the biggest source of it Pollution from past mining is isolated, but severe in places Forest streams listed as impaired in the State of Colorado's 305(b) watershed monitoring report of 1994 are Willow Creek near Creede, the Alamosa drainage and its tributaries, and Kerber Creek and its tributaries Problems in these three drainages are related to mining The Rio Chama is listed as partially impaired from sediment pollution, but the sources have not been identified

Fifteen watersheds (out of over 550) have been identified by RGNF specialists as "Watersheds of Concern" that need more detailed analysis (see Figure 3-73) No watersheds have had more than 25 % of the timbered area harvested Impaired streams listed on the State 305(b) report and Watersheds of Concern are either undergoing restoration work or will be scheduled for a detailed assessment to identify problems and restoration needs

There is 11,160 miles of stream channel, 1,810 of which is perennial, on the Forest Reference streams have been selected for evaluating stream health

Trout live in 1,050 miles of streams, as well as in many lakes, on the Forest and are a valuable recreational resource Forest waters have game and non-game fish, including a Forest Service Region 2 Sensitive Species, a Species of Concern in Colorado, and a state Endangered species Quality fish habitat is provided by protecting stream and riparian area health, which will ensure quality sport-fishing opportunities, as well as native fish communities

The Alternatives allow different levels of activity and associated disturbance In Alternatives that allow more resource use, the potential risk of watershed impacts is increased, but does not make any Alternative unacceptable. Mitigation is available for all activities to prevent violations of State Water Quality Standards and degradation of existing water uses Mitigation is accomplished by properly situating facilities, using conservation practices that exceed voluntary State Best Management Practices, delaying new surface disturbance in Watersheds of Concern, and protecting stream health, as defined by reference sites

INTRODUCTION

Legal Framework

The *Organic Administration Act of 1897* recognized watersheds as systems that have to be managed with care, to sustain their hydrologic function

The intent of the *Clean Water Act*, (actually a series of Acts from 1948-1987) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Required are. (1) compliance with state and other federal pollution control rules, (2) no degradation of instream water quality needed to support designated uses, (3) control of nonpoint-source water pollution by using conservation or "best management practices," (4) government agency leadership in controlling nonpoint pollution from federally-managed lands, and (5) rigorous criteria for controlling discharge of pollutants into the waters of the United States

One purpose of the *National Forest Management Act of 1976* is to prevent watershed condition from being irreversibly damaged, by protecting streams and wetlands from detrimental impacts. Land productivity must be preserved. Fish habitat must support viable populations that are well distributed throughout the planning area.

The *Endangered Species Act* requires federal agencies to conserve Threatened and Endangered species and the ecosystems they depend on

The Safe Drinking Water Act requires federal agencies having jurisdiction over any federally-owned or maintained public water system to comply with all authorities respecting the provision of safe drinking water The State of Colorado has primary enforcement responsibility through its drinking-water regulations

Regulations have been passed in support of these laws that require (1) protecting surface resources and productivity from all natural resource management activities (CFR 219), (2) watershed analysis as part of all planning activities (CFR 219 and FSM 2500), and (3) limiting resource use to protect watershed condition (FSM 2500)

The Forest Service's Rocky Mountain Regional Office, in Golden, Colorado, is developing a *Water Conservation Practices Handbook* (WCP) It will contain direction that applies to all ground-disturbing activities in the Rocky Mountain Region From this draft handbook, standards and design criteria to protect riparian health during project implementation have been incorporated into this Plan

Watersheds

A watershed is a land area that drains all precipitation into a common stream network The RGNF lies almost entirely within the headwaters of the Upper Rio Grande watershed, where water has always been a principal and important resource (Cooperrider, 1937) The Rio Grande drainage extends from the Continental Divide above Creede, Colorado, to the Gulf of Mexico

Figure 3-77 shows the six major drainages (4th-level watersheds) that make up the RGNF They are·

* the Rio Grande above Del Norte, Colorado,
* the Rio Grande from Del Norte to its confluence with the Conejos River,
* the Saguache Creek drainage,
* the San Luis Creek drainage,
* the Conejos River drainage; and
* the Rio Chama drainage

"Man's minimum ecosystem unit is the drainage basin or watershed It includes terrestrial and aquatic systems together with man and his artifacts all functioning as a system" (Odum, 1971) The Rocky Mountain Region Integrated Resource Inventory uses watershed boundaries as ecological boundaries, to enhance ecosystem analysis and management To accomplish this, the RGNF has been divided into different levels of watersheds; the lower the level, the larger the land area

This flow chart shows how RGNF watersheds are broken out by level

WATERSHEDS

3rd Level	4th Level	5th Level	6th Level	7th Level
Rio Grande -	Rio Grande above Del Norte -	South Fork RG -	Beaver Cr -	Cross Cr

Fifth-level watersheds vary in size but generally range from about 40,000-60,000 acres Sixth-level watersheds generally range from 5,000 to 20,000 acres, and seventh-level from 200 to 10,000 acres

Watersheds form a nested group of land areas All 7th-level watersheds fit within the 6th-level watershed, all the 6th into the 5th, and so forth Different levels of watersheds can be selected for different assessment needs by aggregating or disaggregating them The entire Forest can be analyzed as one watershed, or a 7th-level watershed can be isolated for a more detailed assessment

Surface Water and Fisheries

U S Geological Survey quadrangle maps lack a complete stream network The Forest extended the stream network using contour crenulation (map contours exhibiting a definite bend indicate the presence of a channel) All channels are now identified and can be protected All streams, including the stream extensions, are on the Forest Geographic Information System (GIS) for easy display and analysis

There is 11,160 miles of stream channel on the Forest, 1,810 miles is perennial and 1,050 support trout The Forest also has 75 lakes (totaling 1,220 acres) Total miles of stream supporting fisheries has declined, due to impacts from past mining

Trout are the primary sport fish found on the Forest Trout species include rainbow, brook, brown, and cutthroat Of these, only the Rio Grande cutthroat is native Not all cutthroat on the Forest are Rio Grande, however, because there were early fish plants with Yellowstone

and Snake River cutthroat Cutthroat and brook trout are generally found in higher-elevation, smaller streams, while brown and rainbow trout are found in lower-elevation, larger streams

Only one salmon species, the Kokanee (a landlocked sockeye salmon), exists on the Forest *It is restricted to larger lakes*

Several fish species are native to the Forest's waters, including fathead minnow, longnose dace, Rio Grande cutthroat, Rio Grande chub, and Rio Grande sucker The Forest maintains populations of all natives except Rio Grande sucker, although recovery plans include transplanting them to Forest streams

The Forest Service manages fish habitat, and the Colorado Division of Wildlife (DOW) regulates and manges fish populations The agencies cooperate to monitor fish populations and maintain or improve fish habitat on the Forest Recreational fishing days (RVDs) on the Forest accounted for 12 % of all recreational use in 1995, with total number of fishing RVDs up 6% from 1994

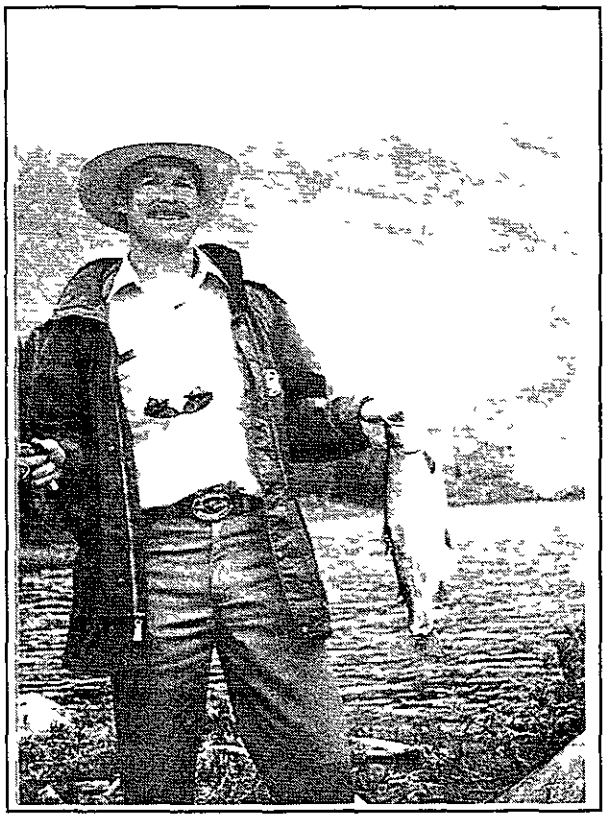
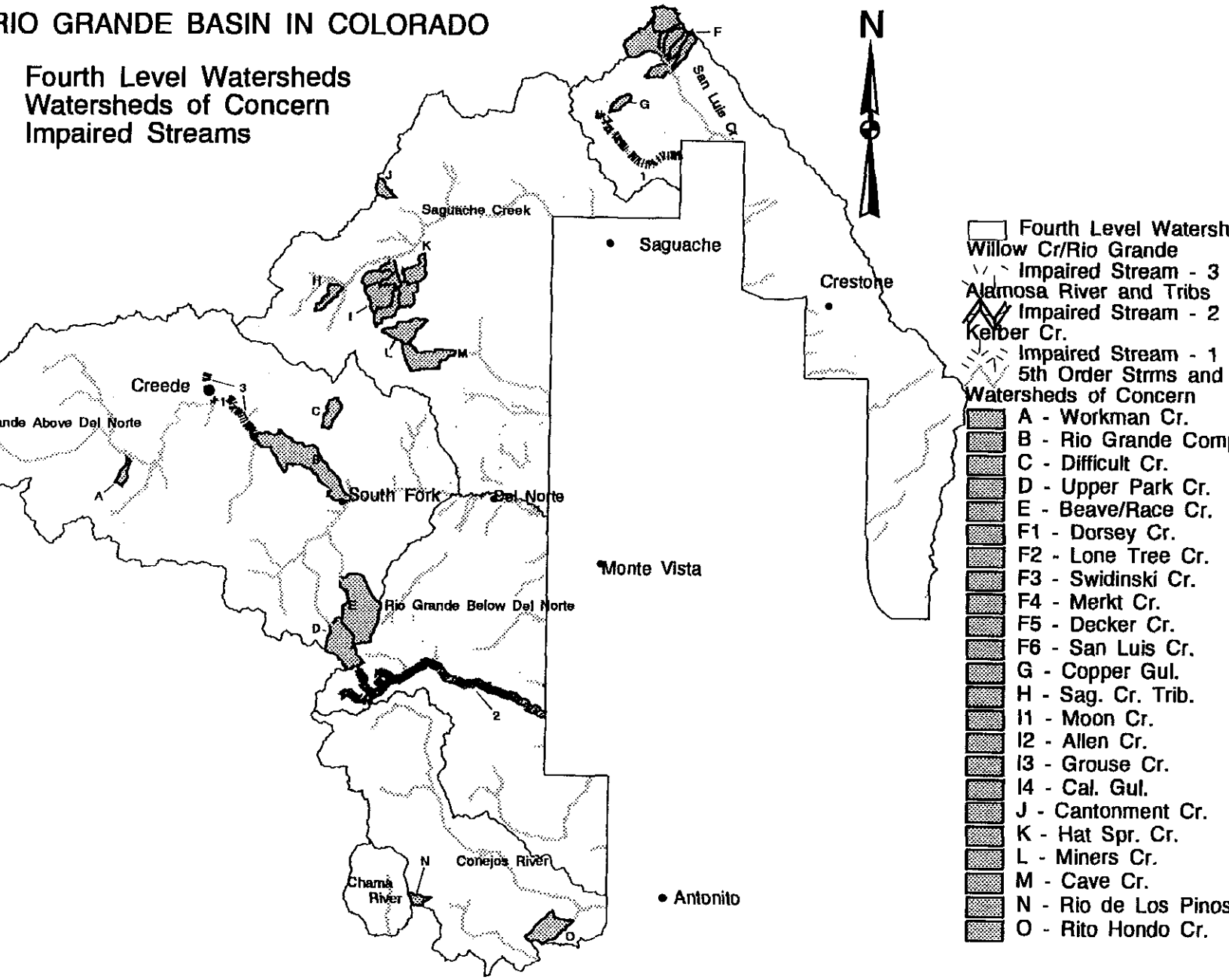


Figure 3-76 Fishing on theRGNF

Surface water on the RGNF comes predominately from snowmelt runoff About 1,300,000 acre-feet (an acre foot of water would cover one acre of land to a depth of one foot) comes from the San Juan Mountains and about 200,000 acre-feet from the Sangre de Cristo Mountains (HRS, 1987) Almost all of this water comes from the RGNF This water is used by Colorado and downstream states (New Mexico and Texas) according to a compact established in 1938 (the Rio Grande Compact)

There is more demand for Rio Grande water than can be met (San Luis Valley Council of Governments, 1975) The RGNF has filed more than 600 water-right applications for domestic, recreation, stock water, and wildlife uses Filing for new uses is ongoing, but constrained by limitations of available water

Perennial streams support aquatic life and riparian communities They are also appreciated for their recreation and aesthetic values Streamflow is needed to maintain channel features that are important for long-term channel health Besides these general values, 20 streams provide habitat for Sensitive fish species, 2 25 miles of stream offer outstanding gold-medal fisheries, and 126 miles of stream are considered eligible for inclusion into the Wild and Scenic River System Neither eligibility nor designation of streams as Wild and Scenic will override existing water rights or negotiated settlements on instream flows


RIO GRANDE BASIN IN COLORADO
Fourth Level Watersheds
Watersheds of Concern
Impaired Streams
N
Saguache
Crestone
Monte Vista
Antonito
Creede
South Fork
Del Norte
Saguache Creek
San Luis Cr.
Rio Grande Below Del Norte
Conejos River
Chama River
Fourth Level Watersh
Willow Cr/Rio Grande
Impaired Stream - 3
Alamosa River and Tribs
Impaired Stream - 2
Kerber Cr.
Impaired Stream - 1
5th Order Strms and
Watersheds of Concern
A - Workman Cr.
B - Rio Grande Com
C - Difficult Cr.
D - Upper Park Cr.
E - Beave/Race Cr.
F1 - Dorsey Cr.
F2 - Lone Tree Cr.
F3 - Swidinski Cr.
F4 - Merkt Cr.
F5 - Decker Cr.
F6 - San Luis Cr.
G - Copper Gul.
H - Sag. Cr. Trib.
I1 - Moon Cr.
I2 - Allen Cr.
I3 - Grouse Cr.
I4 - Cal. Gul.
J - Cantonment Cr.
K - Hat Spr. Cr.
L - Miners Cr.
M - Cave Cr.
N - Rio de Los Pinos
O - Rito Hondo Cr.

Low and high flows are needed to protect stream processes Associated with these processes are important aquatic and riparian habitats, and recreation and aesthetic values It is difficult to quantify needed flows Low flows needs are approximated by median February flows from October to March and median August flows from April to September. High flow needs usually range from 0 7 to 1 2 times bankfull discharge

The Forest has filed with the state for instream flows (a water right to keep water in the channel) on 303 streams A State Water Court decision on these federal-reserved instream-flow claims is pending In 1994 the Forest began negotiating with San Luis Valley private water users to resolve conflicts between existing uses of water and keeping water in streams A successful outcome of these efforts will protect aquatic resources on the Forest without seriously disrupting existing uses of water

Water from the Forest is diverted for many uses Most ditch diversions are located off the Forest Many reservoirs on the Forest capture and store water, primarily for recreation and irrigation (A listing of major reservoirs and diversions is found in Appendix J)

Water quality has improved since passage of the *Clean Water Act Amendments* in 1972 This is primarily a result of reducing municipal and industrial releases of water pollution Less progress has been made in controlling pollutants from land uses (USDA Forest Service, June 1994) As the Forest Service and State of Colorado perfect the ability to measure physical and biological stream components, and develop conservation practices to protect those components, water quality is expected to continue to improve

The towns of Creede, Del Norte, Antonito, and Crestone take, or have taken, water from Forest streams Creede is converting to a groundwater source for drinking water Routine mitigation measures adequately protect water supplies for the remaining towns, and additional protection measures have not been requested

Groundwater

Forest snowmelt recharges ground-water aquifers Recharge to deep, confined aquifers of the San Luis Valley (SLV) occurs almost exclusively near or at mountain fronts, which border the SLV on three sides (HRS, 1987) Streams coming from the Forest also recharge the unconfined aquifer beneath the SLV

Floodplains

Streams naturally have a low-flow channel, a high-flow or bank-full channel, and a floodplain to handle flood events A healthy floodplain with vigorous, deep-rooted plants can withstand the forces of most floods

Floodplains, with associated riparian systems, are very important for regulating the quality of surface water and how that water is distributed over time In good condition, these areas spread out high flows, recharging alluvial aquifers Water is slowly released from alluvial aquifers back to the channel during drier periods of the year

Inappropriate use of these areas includes poorly designed road crossings, unrestrained off-road-vehicle use, livestock trailing, large gold-dredging operations that significantly alter stream banks, and timber slash accumulation Such uses can cause a stream to cut deep into the alluvial aquifer or widen the stream channel, significantly reducing the system's efficiency

AFFECTED ENVIRONMENT

Surface Water and Fisheries

Past uses have impacted watersheds and streams on the Forest. A 1937 report documented accelerated runoff and erosion caused by a decline in natural vegetation It stated that "mountain streams, particularly those in the Upper Chama Basin that drain destructively lumbered and grazed lands, have lowered and widened beds which at points of least gradient are covered with boulders and sand" (Cooperrider, 1937).

In 1994 the State of Colorado's 305(b) watershed monitoring report identified the Rio Chama as a partially impaired stream, although still usable for aquatic life

A 1903 report on the proposed San Juan Reserve also described heavy land uses and damage of Forest streams It specifically described the effect of denudation in the Conejos River drainage and said the same was true for "many other tributaries of the Rio Grande, which have poorly protected watersheds "

Photos from 1875 show riparian areas that were more expansive than they are today The *Range of Natural Variability Assessment* (See Appendix A) describes this information in more detail Forest watersheds, streams, and possibly fish populations are still recovering from these past impacts

Some Forest streams carry sediment from recent land uses Primary land uses affecting stream health include road construction and use, timber harvest, livestock/wildlife grazing, recreation, and mineral extraction. These uses are addressed separately below. They were also considered cumulatively by watershed. Fifteen watersheds have been identified by RGNF specialists as "Watersheds of Concern", they are shown in Figure 3-77.

Past studies identified problems on different streams, including Goose Creek, the South Fork of the Rio Grande, Pinos Creek, and Saguache Creek. High levels of ammonia, nitrate, coliform, and metals (iron and mercury) were detected The metal concentrations were attributed to natural (geological) sources Coliform, nitrate, and ammonia were attributed to livestock grazing and other agricultural practices (CDLA, 1979)

The State of Colorado monitors water quality It recently changed its emphasis from a statewide monitoring system to a basinwide or watershed approach The Rio Grande basin was the first watershed selected for the new approach The 305(b) report, mentioned above, is published every other year The 1994 report contains the results. Figure 3-78 shows locations of water-quality monitoring sites

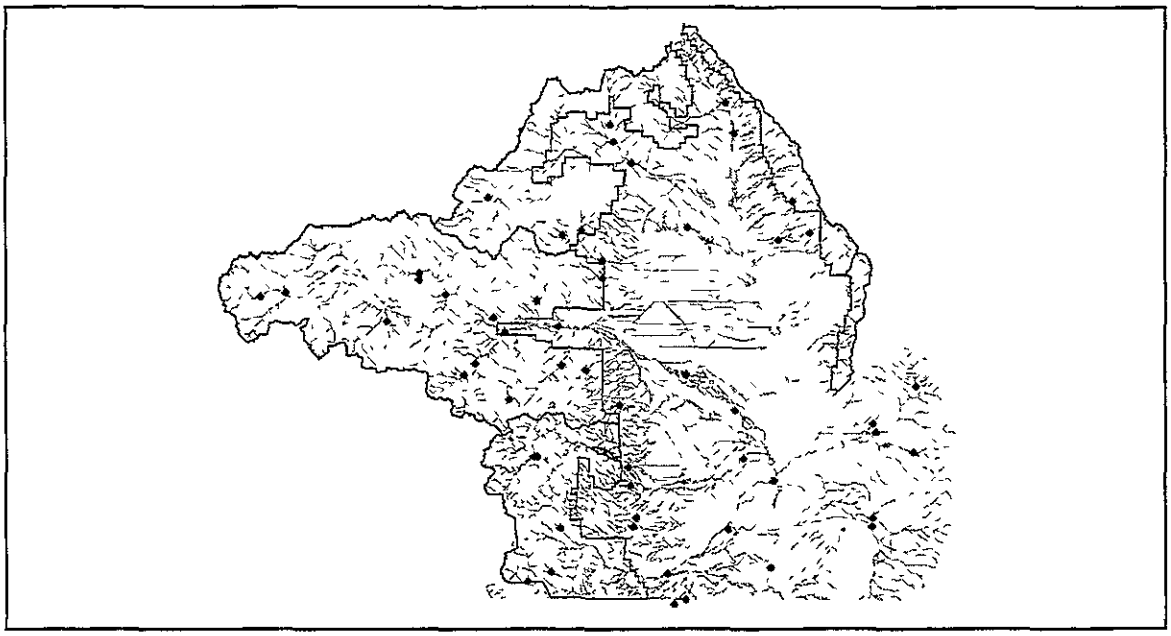


Figure 3-78. State Water Quality Monitoring Sites

There is a wide variety of sport-fishing opportunities, with access ranging from roadside streams and reservoirs to remote backcountry, high-elevation lakes and streams Fishing pressure varies across the Forest with heavy use in some areas The Division Of Wildlife (DOW) manages fish populations in coordination with the Forest to supply both wild trout and stocked populations to Forest streams, reservoirs, natural lakes, and beaver ponds. It is Forest Service policy to maintain—and whenever possible enhance—aquatic resources, to offer better fishing opportunities and ensure biological integrity and diversity

Viability is not considered an issue for most Forest fish populations It may be an issue, however, for Rio Grande cutthroat, Rio Grande chub, and Rio Grande sucker

Rio Grande cutthroat trout were once widespread throughout the upper Rio Grande basin in south-central Colorado (Behnke, 1992) Their current distribution is restricted mainly to headwater tributaries of this native range Rio Grande sucker were also once abundant throughout the Rio Grande basin in Colorado (Jordan, 1891), but were reduced to a single population in Hot Creek

Rio Grande cutthroat is a Forest Service Region 2 Sensitive species and a Species of Concern in Colorado Rio Grande sucker is a state Endangered species, and the Rio Grande Chub is a Species of Concern in Colorado Some natural populations of Rio Grande cutthroat and Rio Grande chub exist on the Forest Several successful reintroductions have established other Rio Grande cutthroat populations, there are now 37 populations on the Forest, seven of which are considered stable. During the summer of 1996, Rio Grande sucker populations were transplanted to two additional Rio Grande basin streams One of these populations was transplanted to a Forest stream The other was transplanted to a stream reach just below the Forest boundary

The DOW has a draft Rio Grande cutthroat trout management plan and a Rio Grande sucker recovery plan The Forest Service supports the DOW goal to increase populations and restore these species to stable, reproducing members of the natural community , and will cooperate with DOW to meet the viability requirements described in the Legal Framework section

A growing threat to local trout is "whirling disease," which is carried by a parasite that attacks primarily rainbow trout The disease attacks soft cartilage of very young fish, causing them to grow with skeletal deformities The malformed fish often display whirling motions as they swim As trout grow to more than three inches, their cartilage becomes bone, and these fish are no longer at risk for the disease Older fish can serve as carriers, though, and can infect younger fish without displaying signs of the disease themselves

DOW research has shown lower numbers of one-year-old rainbow trout in the Rio Grande, leading DOW to conclude that the disease has been communicated to wild fish The DOW has authority for managing and stocking of hatchery-reared fish, even in Wilderness Areas (under the International Association of Game and Fish Agencies Memorandum of Understanding) The Forest will work with DOW and make recommendations for a stocking strategy to minimize the spread of this disease

The State 305(b) report lists streams that have impaired water quality Alamosa, Willow, and Kerber Creeks are listed and shown in Figure 3-77 The presence of metals, with their associated acidity, preclude almost all uses of these creeks Alamosa Creek's pollution is caused in part by natural sources One main tributary, Wightman Fork, drains much of the Summitville Mining District and contributes human-induced metals pollution to Alamosa Creek Mining is the primary source of pollution in the Willow and Kerber Creek drainages Unlike the other two drainages, pollution from Willow Creek reaches and affects the Rio Grande

Except for these three streams, the chemical quality of stream water is generally excellent, with dissolved solids concentrations ranging from 25 to 450 milligrams per liter (USDA, 1978) Dissolved solids concentrations from 1,000-3,000 mg/l are considered slightly saline (USGS, 1970).

The Rio Chama is the only other Forest Stream listed as impaired in the 305(b) report It is shown as partially impacted from sediment pollution, and is also shown in Figure 3-73 The state does not have a sediment standard, so this determination was based

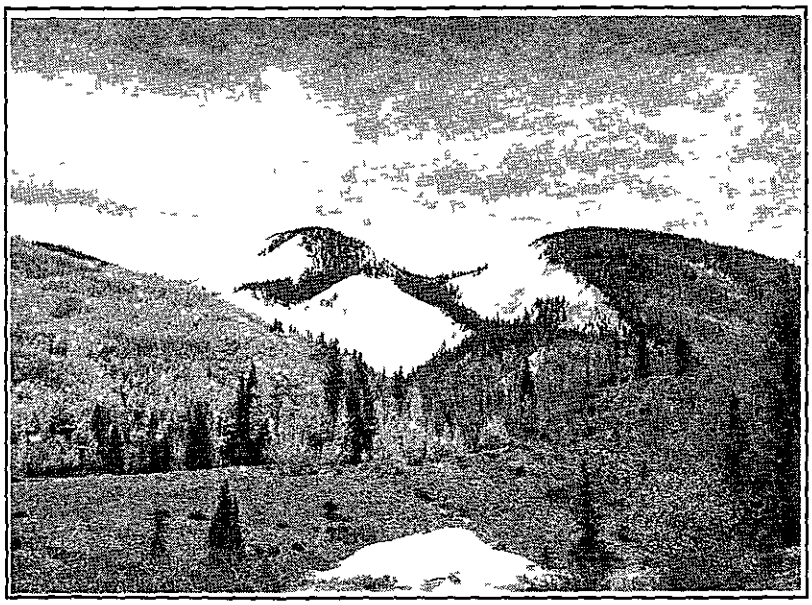


Figure 3-79. Lookout Mountain in the Alamosa Creek drainage, a natural pollution source

on professional judgment The cause of impairment is unknown Impacts may be a remnant of past uses, as described above As the RGNF identifies sources of sediment on National Forest System lands, they are treated with normal mitigation to comply with Plan direction.

All other stream segments on the Forest have water quality as good as, or better than, State standards The State has conducted long-term water quality monitoring on the Rio Grande, the South Fork of the Rio Grande, and on the Conejos River No water quality changes over time have been detected at any station (State 305(b) report)

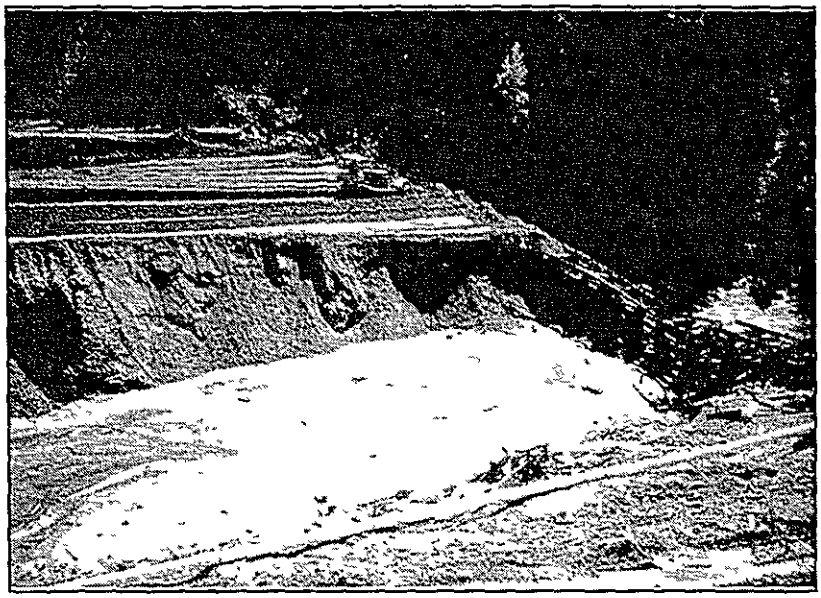


Figure 3-80 Tailing Pile in the Kerber Creek Drainage have been removed during recent reclamation efforts

A handful of reservoirs on the Forest have affected water flows Available data do not show that any streams are dried up completely, some stream flow, however, is substantially reduced The Forest Service is negotiating with SLV water users to see if conflicts between existing water uses and the need to keep water in streams can be resolved Dams and major diversions can change channel dimensions, alter aquatic and riparian habitat, and obstruct fish migration in streams Site-specific project compliance with the resource protection measures and the legal and administrative portions of this section, and with the proposed Forest Plan, will occur as project permits are issued and reissued

The state has monitored water quality on Platoro Reservoir and concluded that it does not appear to be experiencing water quality problems Monitoring of the Rio Grande Reservoir was less detailed, and showed high nutrient levels and a high level of productivity Most reservoirs are at high elevations in unimpacted watersheds, and are not expected to have water quality problems (State 305(b) report)

The RGNF is sampling the most sensitive lakes in all Wilderness areas, to detect any changes in lake chemistry that could result from airborne pollution (This is described in more detail in the Air Quality Section)

Groundwater

Groundwater use on the Forest is low Livestock and wildlife use springs Campgrounds, administrative sites, and a few other dwellings use shallow wells Most groundwater use is in the SLV, outside the Forest boundary Accordingly, groundwater is addressed in this document in less detail than surface water

In general, groundwater quality in Colorado is excellent in mountain areas where snowfall is heavy (State 305(b) report) The RGNF lies within such an area

The places on the Forest that do contribute to groundwater pollution are the same ones that have significant surface water problems These are the areas impacted by past mining, as listed above The RGNF, the Environmental Protection Agency, and the State of Colorado are working on cleaning up these areas

Floodplains

Natural and beneficial floodplains functions are protected through conservation practices that limit floodplain and upland disturbances to acceptable levels The Forest Service's Rocky Mountain Region's *Watershed Conservation Practices Handbook* contains practices that are more stringent than state-required Best Management Practices (BMPs), meet Clean Water Act Section 404 guidelines, and are routinely applied across the Forest, in all management prescriptions (These practices are described in more detail in Chapter III of the Forest Plan)

Flooding of major streams is not uncommon during spring runoff Most documented flood-related problems have been off-Forest in lower elevations The Rio Grande and Conejos Rivers flood occasionally The same is true for La Jara, Alamosa, and Rock Creeks Some channel degradation is associated with the flooding (USDA, 1978)

Forests and Water Yield

Trees use water that becomes available for stream flow when the trees are cut This is explained in more detail in the Direct and Indirect Effects Section

The RGNF is using a model called WRENSS (Water Resources Evaluation of Non-Point Silvicultural Sources) to estimate increased flows. Annual increases in water yield have ranged from 351 acre-feet to 997 acre-feet, with an annual average of 657 acre-feet from 1985-1991, according to WRENSS This model estimates accumulated increased water from past timber harvest to be about 31,000 acre-feet per year, or about 2% of total surface flows

Stream flow resulting from timber harvest can increase stream scour Stream scour effects are not expected to be significant unless more than 25% of a watershed is cut (WRENNS) Increased peak flows may not begin to affect streams until 40% of the basal area is cut (Troendle and Olsen 1993) Of the 6th- and 7th-level watersheds analyzed so far, none have had more than 25% of the timbered area harvested

Timber harvest has contributed sediment pollution Skid trails have sometimes extended directly into stream channels. Landing areas next to the stream and logging debris left in channels have also contributed sediment and affected oxygen levels

Trees next to channels eventually die and contribute to channel structure (Harmon, 1986) Timber harvest close to channels in some cases has reduced natural recruitment of large, woody debris.

Watersheds and specific problem areas are scheduled for restoration as they are discovered, through our Watershed Improvement Needs (WIN) inventory The WIN inventory and resultant restoration work are ongoing, some restoration work is accomplished almost every year

Roads

Roads are the biggest source of sediment on the Forest We have documented about 2,200 miles of roads An additional estimated 300-500 miles of two-track road are undocumented Additional roads also exist as part of old timber sale areas The Forest is in the process of updating the road inventory, and that information will be available for future project work

Seasonal travel restrictions are applied when road surfaces are especially susceptible to erosion and rutting This condition frequently exists during spring runoff

Many existing roads were built too close to streams and have poorly designed stream crossings Sediment from the roads is going directly into Forest streams at the crossings Compliance with Forest Plan Standards and Guidelines and the new *Watershed Conservation Practices Handbook* is expected to reduce sedimentation from newly constructed roads

Bringing problems created in the past into compliance with new protection measures is a big challenge Although the exact number of old crossings and roads contributing sediment to streams is not known, current Forest System roads have about 9,300 stream crossings Also, there are about 960 miles of road within 100 feet of stream channels. Relocating roads is very expensive and controversial People become accustomed to roads, and object to closing them

Solutions to old-road problems will be reached slowly, but identifying road restoration needs has become a routine part of project planning Problems are prioritized, with the worst sites corrected during project implementation Roads do not have to be obliterated to correct design problems they can be disconnected form the stream network by installing proper drainage

About 100 miles of road is planned for closure to motorized use, in part to correct resource problems Decisions on methods of closure will be project specific and dealt with in Environmental Assessments to ensure their effectiveness

Grazing

The main source of stream bank damage on the Forest is grazing by large animals When they reduce or eliminate riparian vegetation, these animals cause channel aggradation or degradation, as well as widening or narrowing of stream channels They also change stream bank morphology. As an accumulative result, this often lowers surrounding water tables (Platts, 1986, out of Clary and Webster)

Division of Water Resources personnel observed instances of channel instability and stream bank erosion on the Forest, which they attributed to livestock grazing They did not quantify the extent or severity of impairment (State 305(b) report, 1994)

Large animals have trampled some stream banks, reducing overhanging bank cover for fish Upper-watershed impacts are occasionally identified, as well Poor-condition rangeland has been included as disturbance in the watershed assessment for this Plan

Fecal material introduces bacteria and pathogens into water bodies Although this has occurred, it has not changed designated uses of stream water, according to the State 305(b) report

A complete inventory of grazing effects is not available Problems are dealt with as they are discovered through normal monitoring If changes in management are needed, they are made through annual operating plans and range permit reissuance. Range use permits include conservation practices designed to protect both upland range and streamcourses.

All existing water developments are believed to have water rights Water rights are secured before new water developments are built

Mining

Mining has been the biggest source of metals and acidity contamination on the Forest Kerber, Willow, and Alamosa Creeks are all affected by mine drainage. (These areas are shown on Figure 3-77)

The Conejos River was also impacted for a short distance below Union Mines, at Platoro Exploration has ceased and reclamation begun The State proposed maximum daily loads for different metals to help address the mine closure.

The most prominent pollution areas were identified and are in some stage of reclamation. Summitville, the biggest source of human-induced metals pollution, is a Superfund site The Environmental Protection Agency (EPA) is leading the multimillion-dollar reclamation job at Summitville The Forest Service is working with potentially responsible parties to clean up pollution sources on National Forest System lands within the Kerber Creek

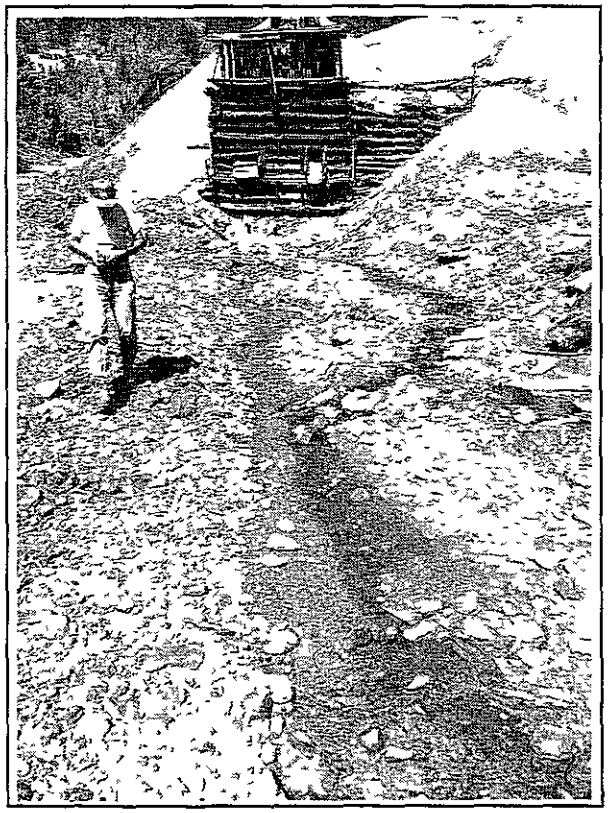


Figure 3- 81 Acidic mine drainage carries high concentrations of metals

drainage Willow Creek has had reclamation work recently by the State Division of Minerals and Geology

The Rocky Mountain Region of the Forest Service has been contracting with the State to inventory all past mining activities Most of the RGNF has been inventoried over the past two years, but results have not been published yet When the inventory is complete and results are in a final report, the RGNF will have a complete assessment of all mining impacts Environmental concerns will be identified by priority, so that funding for cleanup can be sought (Appendix J lists the inventoried sites with environmental problems.)

About 40 acres of disturbance over the past ten years has been associated with locatable-mineral exploration and development Appropriate mitigation has been applied to protect water quality from impacts

Recreation

Recreation has affected surface resources in isolated areas across the Forest Impacts have included bacteria from improper disposal of human waste, erosion from off-road-vehicle use, and loss of vegetation in areas where concentrated camping and horse use has occurred Problems are dealt with as they are encountered This may mean restricting access to areas, or educating the public on Forest Plan Standards and Guidelines and using the land with a lighter touch (as explained in the "Tread Lightly" and "Leave No Trace" programs)

Streams and lakes are a favorite and important place for people to recreate Since no buffer normally exists between users and the water, camping activities can impact stream health Such problems are minor and dispersed

One ski area on the Forest has contributed sediment to streams Bringing the ski area into compliance with Forest Standards and Guidelines has been a priority in recent years

Although data are not available, streams across the Forest are assumed to contain Giardia Recreationists are warned to drink only treated water

Boating occurs on major reservoirs and along the Rio Grande No adverse effects are apparent

Oil/Gas

Oil and gas leasing has no impact on surface resources Exploration has had minor surface impacts associated with drill pads and access roads Since 1982, five holes have been drilled, but impacts were thoroughly mitigated

Range of Natural Variability Conclusions

* Historic photos document that lush, extensive riparian vegetation occurred in the 1870s

* Climatic records suggest a drought during the 1870s Presently, there is a wetter climate than in the 1870s

* If streams supported vigorous and extensive riparian vegetation in the 1870s, they should be capable of doing the same in the 1990s, a wetter period.

* Heavy livestock grazing in valley bottoms caused bunch grasses to die out

* Human-caused fires burned most of the Rio Grande drainage at least once Fires and heavy sheep grazing denuded large portions of watersheds, causing siltation, flooding, and channel erosion These effects almost certainly pushed conditions outside the natural range of variability.

* Streams that remain unstable may not have fully recovered from past land-management abuses.

* Early mining had devastating effects on water quality Streams still seriously impacted by mine drainage and erosion of tailings are Kerber Creek, Willow Creek, and the Wightman Fork of Alamosa Creek The conclusion that these streams are outside the natural range of variability comes from an observed lack of aquatic life and elevated pollution levels

RESOURCE PROTECTION MEASURES

Watersheds and streams can retain a healthy balance with some resource use and disturbance. The RGNF intends to manage disturbances so that healthy watersheds provide needed habitat and clean water This will be accomplished through a watershed-by-watershed analysis to identify the nature and extent of nonpoint sources of pollution, as required by Section 319 of the *Clean Water Act*

Watersheds will be protected in four important ways.

* by assessing risk resulting from past, present, and foreseeable future impacts and from the presence of sensitive areas,

* by using conservation practices (BMPs) to minimize the impacts of land disturbances,

* by isolating most disturbances from water, stream channels and riparian areas, and

* by using reference streams as benchmarks to ensure all streams achieve and maintain robust health.

(1) Watershed Risk Assessment

Watershed condition includes more than just the state of the channel and riparian zone. It also includes the condition of uplands and the effects of previous land-use disturbances (USDA Forest Service, 1993)

An inventory of all disturbances resulting from human activities has been initiated by this Plan Revision All known disturbances have been identified and recorded, watershed by watershed Road acreage and timber harvest area have been totaled using a Geographical Information System (GIS), by overlaying watershed boundaries with transportation systems

and timber harvest areas Other disturbances have been identified by Ranger District personnel All disturbances identified have been converted to an equivalent roaded area and added together to get a total for each watershed, using a method explained in *Watershed Analysis* (Dobson, 1995)

The Forest Service recognizes that all disturbances have not been identified for this EIS For example, roads exist on the Forest that are not available on GIS A more detailed watershed assessment is required at the project level, which will include disturbances not covered for this EIS The road inventory is being updated for that work

Watersheds have been ranked from greatest percent of disturbance to least (a list of the RGNF watersheds with the highest percent of disturbance is in Appendix J) Watersheds of Concern have been identified from this list and are shown in the cumulative impact portion of the Environmental Consequences section and in Figure 3-77 Watersheds of Concern have been identified by considering watershed sensitivity, total watershed disturbance, and disturbances located close to stream channels

For this inventory, "sensitive" watersheds are those with soils in the "high" erosion-hazard class in over 70% of their area, and watersheds with over half their area within 100 feet of stream channels These sensitivity levels were selected by the interdisciplinary team for the following reasons

* High-erosion-hazard soils are more susceptible to disturbance than soils with low erosion hazard The team wanted to be especially careful about disturbances in a watershed predominantly made up of soils susceptible to disturbance

* When over half of a watershed is within 100 feet of a stream channel, the stream density is quite high, and there is a good chance disturbances will be connected to a channel where their effect will be greater

When total watershed disturbance gets high enough, there is some risk that compacted surfaces will increase overland flow and affect stream channels (Harr, 1976) When disturbances are close to stream channels, there is also a high risk that stream health will be impacted

The exact amount of disturbance and associated compaction that will impact a stream channel varies from site to site, depending on site conditions and the type and location of disturbance There is no accurate way to predict exactly how much surface disturbance will cause unacceptable stream impacts

Concern levels have been selected to screen watersheds most at risk It may turn out that these concern levels have been set too high or too low If stream impacts are still apparent in the Watersheds of Concern with the least amount of disturbance, watersheds lower on the list of prioritized watersheds will also be field-checked for stream health impacts

The following concern levels were selected

* 15% of a watershed area in an equivalent roaded area
* 10% of sensitive watersheds in an equivalent roaded area

* 10% of the watershed area within 100 feet of stream channels in an equivalent roaded area
* 25% of the basal area removed from timbered portion of a watershed.

The ID team selected these levels based on professional judgement and available research Some research has shown that when 12 - 15% of a watershed is covered by roads, stream impacts can occur (Harr, 1976) This substantiated that a range of ten - 15%, depending on watershed sensitivity, is reasonable. The concern level of 10% of the watershed area within 100 feet of stream channels was solely based on the professional judgement of the ID team It will be used as a starting point to identify the watersheds most at risk, and may need to be adjusted, based on field assessments

Streamflow is increased when trees are cut This can increase stream bank erosion and resultant sediment levels This process was not accounted for in the watershed-disturbance inventory described above. As explained earlier in the "Forests and Water Yield" section, there should be no impacts when basal-area removal is less than 25% (and maybe even 40%) of the timbered area of a watershed However, because some have suggested that effects from water yield increases should be considered, a concern level of 25% has been selected, to trigger a field assessment to verify whether impacts from increased streamflow occur on this Forest

Watersheds of Concern will be scheduled for a detailed field assessment If stream health has been impacted, a Watershed Improvement Needs (WIN) inventory will be conducted to identify restoration work Restoration will be planned, budgeted, and made a priority for project work

Surface disturbance that could contribute to stream degradation will be avoided in Watersheds of Concern, until stream-health assessments can be completed to supply needed information for decision making If stream health has been impacted, extra mitigation may be required for new surface-disturbing activities, to avoid additional stream impacts These measures will be applied in all Alternatives

Limiting disturbance in Watersheds of Concern until impacts on stream health are verified, restoring problem areas, and requiring needed extra mitigation when stream health has been impaired will ensure that watershed condition is protected, as required by laws described in the Legal Framework section

(2) Using conservation practices (BMPs) to minimize impacts.

As mentioned previously, the Rocky Mountain Region of the Forest Service is developing a *Watershed Conservation Practices Handbook.* The Handbook includes standards and design criteria, proven to be effective in protecting soil, aquatic resources, and riparian areas that will be applied to all Forest activities These criteria have been incorporated in chapter 3 of the Forest Plan as Standards and Guidelines The Forest Service is a leader in controlling nonpoint sources of pollution, because these practices are much more protective than state regulatory requirements

Conservation practices will also help protect watershed condition They limit direct impacts on stream health and help to maintain the chemical, physical, and biological integrity of

Forest waters. Their use complies with nonpoint-source pollution control regulations and with the NFMA

(3) and (4) Isolating disturbances from water/riparian areas and using reference streams as benchmarks.

Reference streams represent the best range of stream conditions available today (on the Forest) They have been subject to the same kinds of natural and human-caused disturbances from past activities as all other streams in the area They have been selected from areas where management activities have allowed some rest in recent years, to show what streams can look like with some recovery By comparing reference to non-reference streams, a measure of stream health is gained, along with a picture of potential stream conditions

New land-disturbing activities will be situated out of, and away from, stream channels as much as possible The incentive for proper location will be the cost of required mitigation for activities located in or close to streams

When new watershed disturbances are proposed, stream-health data will be collected, and compared to reference-stream data If stream health has been impaired, restoration work will be identified, additional mitigation will be required (where needed) to prevent further degradation, and new activities will be isolated from the channel

In all cases, designated stream uses will be protected Limiting impacts so that reference stream conditions are maintained in all streams will ensure full protection of State-designated stream uses This will prevent the degradation of water quality and stream health as required by the *Clean Water Act*

Reference Streams

Obviously, activities in a watershed can affect streams within the area A comparison of stream health attributes between reference streams and other streams will help determine if a stream has been affected

Reference stream comparisons can be only made within similar physiographic settings Two distinct physiographic settings exist on the Forest the Sangre de Cristo and San Juan mountain ranges A third, the San Luis Valley, is influenced by water

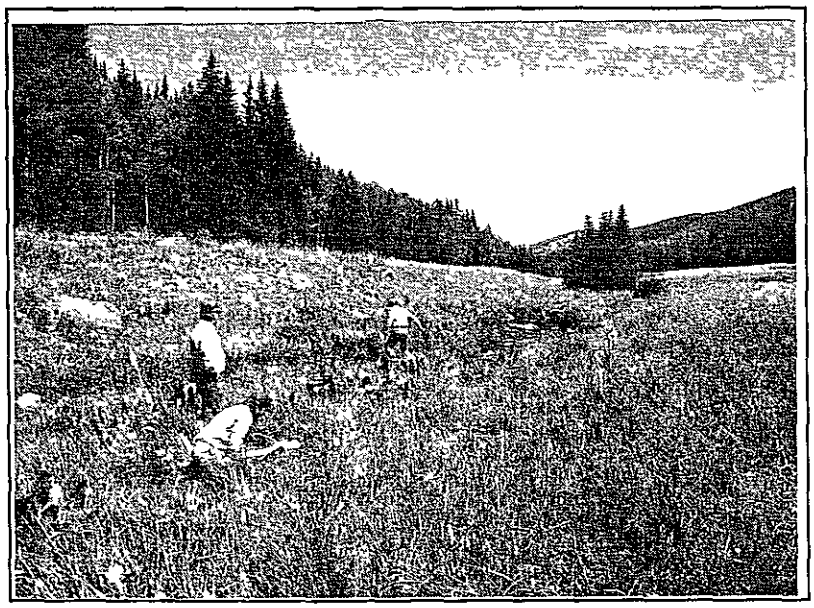


Figure 3-82. Ivy Creek, a reference stream showing a narrow channel with well-vegetated banks

draining from the Forest. Reference-stream work to date has been concentrated in the San Juans, since Wilderness designation prevents much surface disturbance in the Sangre de Cristos

In 1993 and 1994, reference streams were inventoried using a basinwide technique modified from Hankin and Reeves (1988). Streams were walked from mouth to headwaters Each stream was separated into a series of pool and riffle units. Within each pool and riffle, the following stream health attributes were estimated undercut banks, eroding banks, cover, and large woody debris Additional attributes measured in each "reach" were substrate size and width/depth ratio. These attributes reflect both stream health and the quality of fish habitat A reach is a section of stream with similar valley form, stream gradient, substrate, sinuosity, and width/depth ratio

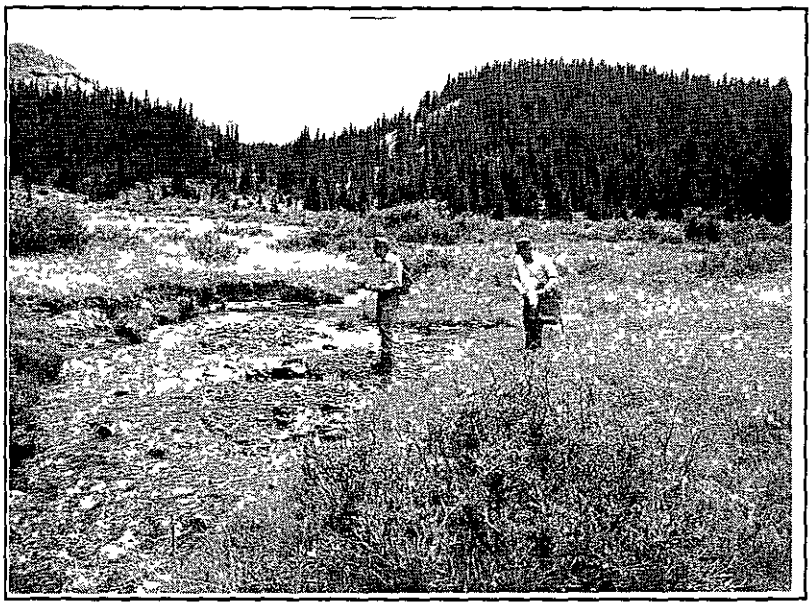


Figure 3-83. Impacted streams have broken banks, widened channels, and impaired stream flow

Of the attributes listed above, eroding banks and substrate composition are directly related to management activities They respond quickly to management and, to some degree, reflect the condition of other attributes

For example, with more eroding bank, there is less undercut bank, less cover in the form of overhanging vegetation, and a wider width/depth ratio over time The amount of eroding bank will show up before the width/depth ratio widens, so the eroding-bank attribute would show more quickly the response to management activities Once the eroding bank heals, the width/depth ratio should start decreasing again

Similarly, percentage of "fines" in the substrate also shows a relationship to management Excess sediment affects many processes in a stream As sediment increases, pools fill in, riffles get longer, embeddedness increases, and stream gradient can change, causing banks to blow out and sinuosity to decrease Plus, identifying areas with excess sediment provides a direct link to management by locating the source

In line with this reasoning, and in order to keep the level of monitoring manageable yet effective, eroding bank and percentage of fines were chosen as the attributes to use for reference stream work (See Appendix J, Table 2)

Many parameters and techniques are available to assess stream health The need for different tools will vary, based on stream characteristics and the problems being assessed Although the above discussion gives our rationale for how reference streams have been assessed to date, the Forest will retain the flexibility to adjust its methods of assessment, to be most responsive and efficient in conducting its assessment work

As new methods become available, the Forest will consider using them The Regional Office is working on a paper now (1996) to describe how different metrics (measurements) can be used to rate stream health Metrics focus on bed, bank, and water quality factors to assess both stream health and associated fish habitat

Data collected on stream health attributes are averaged over a "reach " A reach is a section of stream with similar valley form, stream gradient, substrate, sinuosity, and width/depth ratio Stream reaches are described using Rosgen's stream classification system (Rosgen, 1994) Stream reaches that will be compared to reference reaches must be of the same type as described by that classification system A simplified version of the channel types follows

Channel Types	**General Description**
"A" type channels	* generally steeper headwater streams * usually located in confined valleys * very low sinuosities and width/depth ratios * often characterized by large substrate size
"B" type channels	* lower gradient mid-elevation streams * usually located in more open valleys * moderate sinuosities and width/depth ratios * variable substrate size
"C" type channels	* generally flat low-elevation streams * usually located in broad valleys * high sinuosities and width/depth ratios * smaller substrate sizes

Channel types (A,B,C,) are followed by a number defining substrate size The smaller the number, the larger the substrate size The goal is to be as accurate as possible in making stream-health assessments and comparisons to reference streams

Nine streams were surveyed in 1993 and 1994 making up 32 stream miles 13 miles in the "A" classification, 18 in the "B" classification, and 1 3 in the "C" classification (See appendix J, Table 1)

These surveys are a tool for evaluating stream health Stream health will be determined by comparing reference-stream to non-reference-stream values We will continue to collect data and results will be updated More reference streams will be added as good candidates are found

The Forest Service Region 2 nonpoint-source management strategy (WCP Handbook) explains that reference-stream monitoring will be used as a feedback mechanism to modify

land management activities, adjust conservation practices, and, if necessary, make recommendations to change State water quality standards

Drinking Water

Drinking water will be protected by complying with State regulatory requirements These include collecting periodic samples from all water supplies that serve the public Samples are sent to an EPA-certified lab for analysis Analysis results are then sent to the state for review. If violations are detected, the results are posted and the problem corrected

DIRECT AND INDIRECT EFFECTS

Surface water, fish, groundwater, and floodplains are all closely related They will be addressed together, since effects on all of them are similar When they are impacted differently, it will be specifically noted and described Detailed effects on water are described in many different hydrology texts The effects described below are only those that stem from how well the land is managed and used

Achieving long-term stream health and habitat for viable fish populations will be a priority in all Alternatives Implementation of resource protection measures is expected to achieve both as long as they are properly and consistently applied There will be no effects to sanctuaries or refuges since non exist within the planning area

When vegetation is removed, the ground becomes exposed to natural erosive forces, and water is held on the land for a shorter time Less moisture soaks into the ground and more runs off quickly, carrying sediment with it In extreme cases, floods result, leaving less water available for summer and fall streamflow. When the surface is compacted, this effect is increased (Dunne & Leopold, 1984 Harr, 1976)

Trees take up water through their roots, incorporate it into tissue, and release it into the air (transpiration) Trees also capture precipitation and allow it to evaporate. Both processes together are called "evapotranspiration" Much of the water lost to evapotranspiration becomes available for streamflow when trees are removed This additional water benefits consumptive uses, if the increases are measurable (at Colorado Division of Water Resources index stations) Rio Grande Compact delivery requirements are based on flow rates at index stations

Figure 3-84 Trees divert water back to the air through transpiration and evaporation

Different conifer species use different amounts of water Spruce trees use more than almost all other conifer species Since a majority of the Forest is covered by spruce trees, the effect of tree removal on water yield is greater here than in many other

areas. In the past, the Forest has promoted tree harvesting to increase water yields, since the Rio Grande is an over-appropriated system There has been no local support for this objective, so these proposals were dropped Relative effects of harvest on water yield will be described between Alternatives, but will not drive timber harvest

Effects on Water Resources from Timber Harvest

Trees use water that becomes available for streamflow when the trees are removed (USFS, 1980) As real as this increased water yield is, it is such a small increment of total water yield that it can rarely be measured in larger watersheds Annual variation in precipitation make increased streamflow from tree removal unnoticeable, except in the most carefully monitored watersheds

Increases in streamflow resulting from tree removal occur mostly during spring runoff and summer, but are not permanent (USFS, 1980) As an area is restocked and the trees mature, water that was available for streamflow is slowly redirected back to evapotranspiration We expect this process to occur linearly over about 70 years for the majority of the RGNF

Studies show that increased runoff and sediment produced by disturbed soils are the major cause of stream impacts Roads and other disturbed soils can impair the ability of the land to absorb water and filter sediment, but cutting trees normally does not Aggressive tree cutting has been shown to increase small peak flows and channel erosion, but stream health has not been damaged if watershed conservation practices were used

Disturbed areas connected directly to stream channels are the main source of damage in rain (Ziemer, 1981), snow (Troendle and Olson, 1994), and rain-on-snow areas (Jones and Grant, 1996) Improperly designed roads and skid trails, and the lack of adequate buffers around water bodies are the greatest concerns (Troendle, 1987, Troendle, 1986, Heede 1987) Our watershed assessment focuses on actions that damage streams directly or impair the "sponge and filter" qualities of the land

Studies also show that normal land management with sound watershed conservation practices may increase small peak flows but not large floods All forest and project plans contain regional watershed conservation practices, so effects of land management of flood risks are negligible and will not be assessed further except in rare situations

Table 3-53 displays the amount of increased water yield by Alternative Water yield increases have been estimated using WRENSS Since no timber harvest is scheduled for Alternative A, increased streamflow from past harvests would slowly decline over time

Table 3-53 Water Yield Increase by Alternative - Experienced Budget Level (for 1st Decade)

Water Yield (Acre Feet)	ALTERNATIVE						
	A	B	D	E	F	G	NA
Full Budget	0	11,638	9,266	5,967	3,275	7,326	8,407
Experienced Budget	0	2,594	1,891	1,589	882	1,718	1,668

FORPLAN is the model used to project the amount of timber harvested by Alternative In Watersheds of Concern, the model delays timber harvest, to allow for any needed recovery

time These delays are form 1-7 decades, depending on the severity of existing disturbance Delays are factored into a 200-year cycle, and have only a small effect on projected harvest levels Any actual project limits will result from case-by-case management decisions based on more detailed information from a project-level assessment.

Timber harvesting too close to a stream channel can plug the channel with logging debris An adequate buffer next to streams is a required conservation practice The idea is to prevent the accumulation of fine materials, but allow the natural recruitment of large woody debris needed for bank stability, energy dissipation and fish habitat

There is little difference in groundwater recharge between Alternatives Alternatives with less harvest and more road obliteration would conceivably allow for more recharge However, Alternatives that remove more trees result in less groundwater withdrawal by evapotranspiration Watershed conservation practices are designed to protect aquifers

Impacts from timber harvest will be minimized as described in Resource Protection Measures Some risk of impacts on water resources and associated fish habitat exists if activities are not carried out as planned, or unexpected conditions are encountered. These risks increase with greater levels of activity All Alternatives are achievable, but based on different levels of activity, the relative risk associated with each Alternative is shown in Figure 3-85

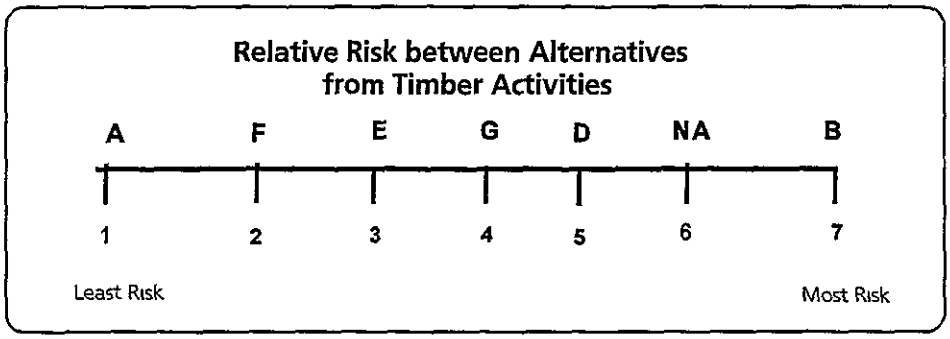


Figure 3-85. Relative Risk Between Alternatives from Timber Activities

Effects on Water Resources from Roads

Roads affect water quality negatively Their effects can be greatly reduced by proper location and design. When this is not done, water is allowed to run down the road into stream channels carrying a heavy sediment load Good road location keeps them away from stream channels, riparian areas, steep slopes, high-erosion-hazard areas, and areas of high mass movement

The effects of increased sediment are both economic and ecologic Sediment does not dissipate and is eventually carried through the stream system until it reaches a structure, where it either shortens the structure's life or results in cleaning costs Since channels are interconnected, sediment delivered to ephemeral channels is moved to perennial channels during spring run-off Unnatural sediment loads impact stream health by reducing oxygen, reducing pool depths, changing channel morphology, filling pore spaces used by macroinvertebrate life, adhering to gills of aquatic life, reducing fish reproduction success,

and damaging associated habitat (Minshall, 1984, Cordone, 1961, Murphy, 1981, Newcombe, 1991, Gardner, 1981).

Roads significantly disrupt normal floodplain functions, by removing vegetation and redirecting flows Proper management is to situate roads outside floodplains and cross floodplains only when absolutely necessary, and then only at well-designed and protected crossings

Watershed conservation practices require proper location and design of roads When these practices are implemented, virtually all water quality impacts are avoided Road closures are proposed for all Alternatives Closing and rehabilitating road surfaces will reduce sediment loads and associated impacts

Mitigation of road impacts will be constant in all Alternatives If mitigation is properly applied, there will be little difference in impacts between Alternatives

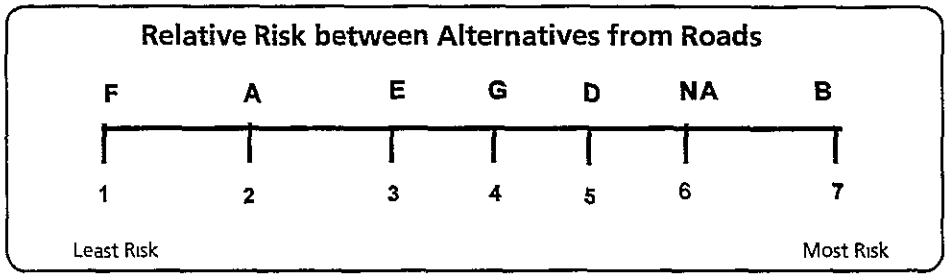


Figure 3-86 Relative Risk between Alternatives from Roads

Alternatives with more road activity have some increased risk of impacts to water resources and associated fish habitat, from unanticipated problems or failure to apply mitigation correctly That level of risk is shown in Figure 3-86

Effects on Water Resources from Fire

Low-intensity fires leave sufficient organic matter to protect the ground surface High-intensity fires, however, can consume duff and litter, kill much of the vegetation, and create hydrophobic (water-repelling) soil conditions. Increased overland flow increases stream flow, and possibly peak flows, until the area is revegetated

Prescribed fires, in which the timing and behavior of fire are controlled, minimize water repellency and associated negative effects on water quality Like other disturbances, they need to be kept out of stream-protection buffers Like any removal of trees, fires result in increased stream flow that is accounted for in assessing past disturbances, when data are available

Little difference in effects from fire is expected between Alternatives Alternatives A and F may have more opportunities for PNF Wildfires may be larger in these two Alternatives, due to lack of access

Effects on Water Resources from Grazing

Livestock grazing can affect the riparian environment and associated stream ecosystems if use exceeds site capability (please see the Riparian section) When this occurs it is commonly called "overgrazing " The immediate effects of overgrazing are loss of streamside vegetation and trampling of stream banks Trampling causes physical bank damage, in the

form of caving and sloughing, that contributes to erosion and sedimentation This occurs, in part, because livestock congregate along streams for shade, food, and drinking water Erosion can also lower water tables enough to reduce streamflows during critical base flow periods (Armour, et al , 1990)

Long-term overuse can cause the conversion of deep-rooted plants (i e , sedges) to shallow-rooted ones (i e , Kentucky blue grass) The resultant decline in root mass coincides with a reduction in bank stability, making the bank more susceptible to erosion

Overgrazing is considered one of the principal factors contributing to the decline of native fish in the West Fish are affected by reduction of shade, cover, and terrestrial food supply Resultant increases in stream temperature, changes in water quality and stream morphology, and the addition of sediment (through bank degradation and off-site soil erosion) also affect fish and other aquatic life they depend on Overhanging banks are important fish habitat that can be eliminated by the weight of livestock, especially if deep-rooted plants are removed. (Armour, et.al ,1990)

Excess sediments settle into spaces between gravel where fish eggs incubate This hinders the emergence of hatched fish, water flow in gravel, and the resupply of oxygen needed for small organisms Sediment can also cause abrasion and interfere with functions of invertebrate respiratory systems (Armour, et al , 1990)

Cattle also release ammonia and nitrogen into streams These nutrients can cause algae blooms When algae die and decompose, oxygen is further depleted

Overgrazing can change channel shape, forcing flood flows--that would normally be spread out over a floodplain--into an oversized channel Concentrated flows in the channel have more erosive force that further erodes stream banks Stream bank erosion produces more sediment, that is deposited elsewhere If sediment cannot be deposited onto a floodplain, it is deposited in the channel, forcing stream energy into the banks and causing more stream scour This vicious circle can be stopped if management is changed, the stream will eventually readjust This usually happens by redefining a low-flow channel within the oversized channel Readjustment back to the original healthy system can take decades

Conservation practices are designed to limit grazing use of good-condition sites, prevent declines in stream health and fish habitat, and allow recovery for streams that still show signs of past impacts There is some risk of impact Wildlife populations could outgrow available forage Conservation practices might be misapplied, or could be inadequate for unexpected circumstances These risks are not expected to be significant in any Alternative Risks would decrease in Alternatives A, E, and F, because they have the potential to reduce livestock use

Effects on Water Resources from Mining

Mining can also cause significant impacts Mine waste and mill tailings increase available surface area for contact with water As water interacts with sulfate minerals, sulfuric acid is formed The acid then dissolves metals, putting them in solution If concentrated solutions reach a water body, aquatic life and riparian vegetation will die Loss of bank-armoring vegetation, in turn, allows banks to erode

Fine tailings can be washed into stream channels, contaminating bed sediments Even if water quality is improved, bed sediments remain as a source of metal pollution for fish and other aquatic life

Some mining simply disturbs the surface Placer operations can destroy stream banks as material is dredged and processed Exploration can leave surfaces exposed to erosive forces

Past problems were described in the Affected Environment section Future activities cannot be eliminated, but can be constrained to protect the floodplain, and water quality Mining is not expected to vary by Alternative We expect about 40 acres to be disturbed during the ten-year planning period The areas impacted are expected to be small, and Operating Plan Stipulations will protect critical areas

Effects on Water Resources from Recreation

Streams are a favorite place for people to recreate Concentrated use significantly impacts vegetation that normally protects the sites It also adds to site compaction Associated uses, including toilet facilities, dishwashing, trash accumulation, and horse use, can all contribute pollution

A key to stream protection is the proper location of uses Many developed camp sites have been situated within the floodplain, and should be moved as opportunities become available Dispersed camping must occur a short distance from the stream, as well Horses need to be pastured away from the riparian area Off-road-vehicle use can cause impacts similar to those from roads, and must be kept out of riparian areas except on roads with designated crossings All of these measures are requirements found in the *Watershed Conservation Practices Handbook*

Snowmobile use has some effect on water-holding capacity, as snow is compacted (Neuman, 1972) There are no indications that snowmobile use has caused any noticeable impact on Forest watershed or stream conditions

Recreational mining is expected to continue Where there is the potential for damage to water quality and riparian vegetation, miners are required to file Notices of Intent and Operating Plans Stipulations attached to operating plans are intended to mitigate damage of surface resources

Recreation has been increasing on the RGNF, and increased use means increased impacts to water resources To help alleviate these, new concentrated-use sites will be situated away from riparian areas Dispersed camping next to water bodies will be discouraged Impacts will be monitored and use regulated, if necessary, to prevent adverse impacts

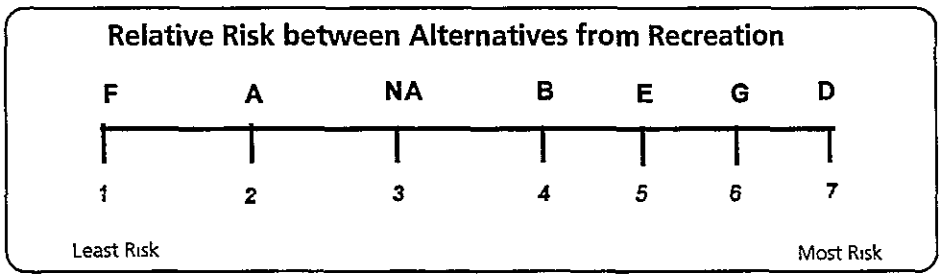


Figure 3-87. Relative Risk between Alternatives from Recreation

As more land is allocated to recreational uses, the risk of impacts on water resources from recreation goes up (Relative risk between Alternatives is shown in Figure 3-87)

Effects on Water Resources from Oil and Gas Leasing

No significant effects are expected from oil and gas leasing. Exploration can involve surface disturbance if new roads or drill pads are constructed Drilling could allow water from one aquifer to contaminate water in another

If exploration reveals producible quantities of oil or gas, a producing field could be developed Effects from such a field would include more surface disturbance

Disturbance and activities would vary slightly by Alternative Alternatives A and F would involve only one well and about 14 acres of disturbance All other Alternatives are projecting 23 exploration and development wells, with about 129 acres of disturbance

A No Surface Occupancy (NSO) Stipulation will be used to protect Watersheds of Concern for all lease options except B1 The NSO Stipulation will be dropped when more detailed study verifies the risk to watershed health is low

CUMULATIVE IMPACTS

Watersheds and streams can tolerate a certain amount of use and disturbance without breaking down The RGNF intends to manage disturbances so that the cumulative total remains within a range needed to provide habitat and continued use of water resources

This will be accomplished by assessing the cumulative impacts of all past, present, and foreseeable future disturbances, to derive a projected total The total will be used to identify Watersheds of Concern and associated risk from more activity Watersheds will be assessed at the 6th level, and in some cases the 7th, in order to compare the level of disturbance to watershed capability

For this assessment all disturbances were accumulated, watershed by watershed, using a method described in the Resource Protection Measures section Future activities proposed in the Alternatives cannot be assessed using a watershed by watershed method at this broad level of planning We will not know which watersheds will be affected until actual projects are proposed At that time, cumulative impact assessment work initiated in this plan will be updated and expanded to include those proposed activities Stream health assessments will also be made at that time If stream health has been impaired, new activities will be avoided or mitigation added, to protect the stream from further impairment, and improvement work will be proposed for project implementation The intent will be to reduce disturbances connected to stream channels to as near zero as possible

Based on the level of data available our watershed cumulative impacts assessment has identified fifteen Watersheds of Concern which are shown in Figure 3-77 and listed in Table 3-54

Table 3-54. Watersheds of Concern

Watersheds of Concern	
Watershed Name	**Watershed Number**
Unnamed Tributary to Saguache Creek	13010004010307
Cave Cr	13010004090106
Workman Cr	130100010603
Rio Grande Composite	130100011103
Rito Hondo Cr	13010005060301
Cantoment Cr	13010004020501
Difficult Cr	13010001120101
Miners Cr on Saguache District	13010004090103
Upper Hot Spgs Cr	13010004030102
Upper San Luis Cr	130100030104
Rio de Los Pinos Trib	13010005050101
Saguache Cr	130100040202
Upper Park Cr	13010001130501
Beaver/Race Cr	13010001130701
Copper Gulch	13010003020104

These watersheds will be evaluated more closely for restoration needs, and for actual or potential impacts on stream health The overall risk of watershed impacts between Alternatives is proportional to the level of surface-disturbing activities Although all Alternatives are achievable, the relative risk to watershed health would vary, as shown in Figure 3-88

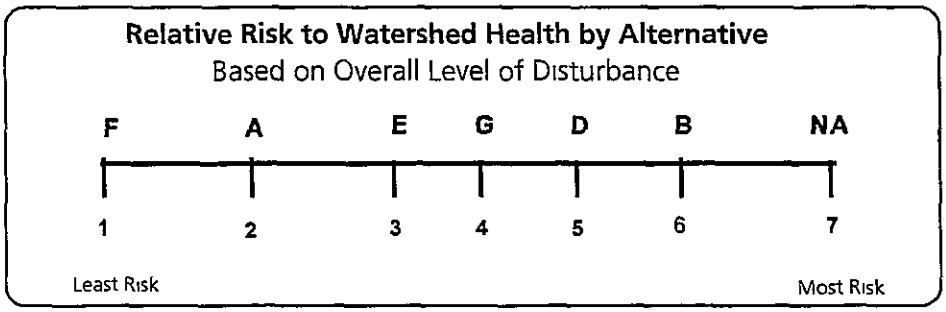


Figure 3-88. Relative Risk to Watershed Health by Alternative Based on Overall Level of Disturbance

SOIL RESOURCES

ABSTRACT

The soils on the Forest are in cold climatic zones in mountainous topography They are shallow to very deep, usually contain considerable rock fragments, and were formed in primarily volcanic rocks on mountain slopes

To maintain soil productivity, soil damage such as erosion, compaction, and displacement must be maintained within tolerable limits Severely burned soils and nutrient removals must also remain within allowable limits Soil productivity can effectively be protected using mitigation measures that reduce impacts. Management activities proposed in the Alternatives are designed to be compatible with soil and ecosystem capabilities.

The Alternatives affect the soil resources to various degrees Alternatives NA and B have the greatest effects Alternatives D, E, and G have moderate effects Alternative A and F have the least

INTRODUCTION

Legal Framework

The *Multiple-Use Sustained Yield Act of 1960* established that the sustained yield of goods and services must be conducted without permanent impairment of the productivity of the land *The National Forest Management Act of 1976* requires the Forest to "insure the effects of each management system to the end that it will not produce substantial and permanent impairment of the productivity of the land "

Soils

Soils are the foundations of the ecosystems that flourish on them They are fixed resources, nonrenewable by even the most modern technologies. The primary goal of soil management on the Forest is to maintain soil productivity and soil health, so that ecosystems can be sustained for the many benefits they provide

Historical photos taken before 1900 show that considerable bare soil existed after unmanaged logging, grazing, mining, and wildfires had destroyed protective layers such as leaf litter and vegetation (as described in Appendix A, FEIS) Significant soil erosion occurred, and we estimate that some site productivity was lost Since then, vegetation cover has returned and stabilized soils to the extent that natural soil processes have recovered, though soil productivity may still be less than what it once was.

Today, we have the means to plan and carry out management activities carefully, while protecting soil productivity The desired condition for the soil resource is to keep soils healthy Healthy soils and ecosystem sustainability can be assured if soil damage such as

erosion, displacement, and compaction do not exceed allowable limits Severely burned soils and nutrient removals must also remain within allowable limits

Healthy soils have adequate vegetative cover, commensurate with site capabilities, have functioning nutrient cycles through natural decay or periodic burns, do not have significant nutrient drains through excessive organic removals; have good soil structure for plant root growth and development, have good infiltration, do not have hydrophobic (water-repellent) conditions from burns; have healthy populations of soil fungi, bacteria, and small insects that perform many useful functions for plant growth; and are capable of maintaining the original potential ecosystems for the long-term Healthy soils can provide social benefits such as wood products, forage for livestock and wildlife, water, recreation, minerals, and aesthetics. These benefits can be continued for the long-term, provided soil health is maintained or improved

Soil Resource Inventories

Recognizing the importance of soils information as an integral part of land management planning, the Forest began an intensive soil resource inventory effort in 1980 Since then, soil resource inventories (SRIs), also known as Soil Surveys, have been mapped for the entire Forest

The Forest used soils data in the Forest Plan Revision process to blend our management activities with the ecological capabilities and potentials of the land SRIs have been compiled into two publications *The Draft Soil Survey of the Rio Grande National Forest - West Part*, and the *Draft Sangre de Cristo Soil Survey* Each inventory consists of a report, interpretations, and maps that show where specific soil types occur The West Part Survey, on which most of planning analysis is based, has undergone a number of quality reviews, including Final Correlation In this review process, the Regional Forester described it as "one of the most efficient and effective soil surveys in this Region to date" (Both reports are available for review at the Supervisor's Office in Monte Vista)

To help the Plan Revision process, soil map units have been entered into the Rocky Mountain Resource Information System (RMRIS) database This improved planning and analysis opportunities for the various Alternatives SRIs were the basis for development of ecological units, landtypes and landtype associations described elsewhere in this Chapter

Planning and Project-Level Soil Evaluations

Soils information is used and analyzed at both the Forest-planning and project levels This EIS presents an overview of the Revision Alternatives and their effects on the soil resource, based on the Draft SRI information The SRIs were developed for planning purposes and have been appropriately used in this Forest Plan Revision However, when projects are proposed, an on-site investigation should be conducted to obtain more specific soils information Specific mitigation can be developed based on the potentials, capabilities, and limitations of the soils at the site

Soil erosion analysis was conducted using the Modified Soil Loss Equation as an index of soil erosion In this equation, the greater the index, the greater the effects on soil erosion Important management actions affecting soils include timber harvesting and road building,

as well as fire, recreation, minerals, travel, and range management All other uses are expected to have limited effects on soils.

Watershed Improvements

The Forest has an active Watershed Improvement Program Its main purpose is to restore damaged watersheds The amount of acreage identified for restoration varies by Alternative Watershed improvement needs are prioritized through watershed assessments, but are flexible, to adjust to changing conditions

AFFECTED ENVIRONMENT

There are about 120 soil units or landtypes that describe the soils, potential natural vegetation, climate, topography, and geology across the Forest It would be impractical to describe the 120 soil map units in this Environmental Impact Statement (EIS); however, a general description of the major soil types is contained in the landtype association descriptions Both landtypes and landtype associations will be used to analyze the effects of the Alternatives on soil productivity

Soils on the Forest formed in volcanic rocks on mountainous topography The soils occur in cold climatic regimes where precipitation varies from eight inches to more than 50 inches annually Soils are shallow to very deep, contain considerable rock fragments, and support a diverse variety of ecosystems

RESOURCE PROTECTION MEASURES

Five categories of physical soil disturbances have been found to affect soil productivity compaction, displacement, erosion, puddling, and severe burning (FSH 2509 18 Chapter 2, Soil Quality Monitoring 9/3/91) Soil damages may not exceed 15% of an activity area

Soil protection and mitigation consist of Standards and Guidelines designed to protect the productivity of the land through watershed conservation measures Standards, which *must* be done, Guidelines *should* be done

The soil protection Standards and Guidelines are based on the October 3, 1996 Edition of the *Watershed Conservation Practices Handbook* (WCP) These mitigation measures were developed over the past four years and have undergone peer reviews by FS specialists including hydrologists, soil scientists, foresters, and others The Standards and Guidelines also have been through public review through this Revision effort We received numerous comments from the public, both pro and con, that resulted in revisions of the proposed direction in the DEIS We believe these conservation measures to be appropriate and necessary to maintain soil productivity

All of the WCP Standards and Guidelines will serve to protect our soil and water resources Some specific ones that focus on soil resources and protection are discussed below

STANDARD: Manage land treatments to limit the sum of severely burned and detrimentally compacted, eroded, and displaced land to no more than 15% of any land unit.

Severe burns can kill soil biota, alter soil structure, consume organic matter, and remove site nutrients Risk of soil damage depends on fire severity, which differs from fire intensity An intense slash burn conducted when soil, humus, and large fuels are moist will seldom be severe Severe fires occur when humus and large fuels are dry and fuels are concentrated near the ground, so that they conduct much heat into the soil The soil is sterilized, infiltration and porosity are reduced, the litter and humus, half of soil organic matter and nitrogen, and much phosphorus may be lost, recovery takes years

Soil compaction is caused by the weight of vehicles, humans, and animals on the ground It increases soil density and reduces large pores. Detrimental soil compaction may include soil puddling and impaired infiltration, restricted root growth, and reduced soil biota Detrimental compaction can penetrate to two feet in roads, major skid trails, and log decks In such areas, tree growth may be reduced by more than 50% and recovery may take decades

Compaction hazard depends on soil texture, soil moisture, ground cover, rock content, and the number of machine passes Clayey and loamy soils are more readily compacted than sandy ones, especially when soil moisture exceeds the plastic limit (the moisture content at which a soil changes from semi solid to plastic) where soils are easily deformed Detrimental compaction may occur with one to three passes in moist soils, but may take many passes in dry soils Slash and litter buffer the soil against compactive pressures

Guidelines

* Restrict roads, landings, skid trails, recreation sites, livestock gathering areas, and similar soil disturbances to designated sites

* Operate heavy equipment only when soil moisture is below the plastic limit, or protected by at least one foot of packed snow or two inches of frozen soil

* Conduct prescribed fires when soil, humus, and large fuels are moist

Restoration measures for this Standard and Guidelines include subsoiling and tilling to reduce deep compaction Seeding, fertilizing, and mulching mitigate severe burns Planting native legumes enriches the site by adding nitrogen Another option is closing, reclaiming, and hardening sites that have soil pedestals or rills when concentrated recreation or livestock use occurs

STANDARD: Prevent detrimental removal of organic matter and nutrients from any land.

Guidelines

* On soils with topsoil thinner than one inch, topsoil organic matter less than 2%, or effective rooting depth less than 15 inches, retain 90% or more of the fine logging slash

(less than 3 inch diameter materials) in the stand after each clearcut and seed tree harvest, and retain 50% or more of such slash in the stand after each shelterwood and group selection harvest, considering existing and projected levels of fine slash

If machine piling of slash is done, conduct piling to leave topsoil in place and to avoid displacing soil into piles or windrows

Nutrient loss occurs when organic matter and nutrients contained in leaves, limbs, litter, humus, and topsoil are moved off-site Careless piling that moves one inch of topsoil, may remove half the nitrogen and large amounts of phosphorus, potassium, calcium, and magnesium from the site Long-term soil productivity is reduced by nutrient deficiencies when organic matter that supplies nutrients over time is displaced off-site

Total-tree harvest removes the whole above-stump tree from the site Loss of nitrogen, and other nutrients can be several times that with bole-only harvest Nutrient studies show that soil productivity may be reduced by one total-tree harvest on poor soils and by repeated whole-tree harvests in rich soils.

This standard focuses on reducing nutrient losses due to removal of branches, biomass harvesting, and piling and burning of organic materials "Sustained-yield forestry probably cannot be achieved in the Rockies without careful management of stand nutrition" (Binkley, 1990) Many studies have identified risks to soil productivity caused by the removal of excessive organic matter

The soil ratings for total tree harvest are based on criteria established in the *National Soils Handbook* (USDA, Soil Conservation Service, 1993). The evaluation and mitigation are necessary to protect and maintain soil productivity, and is based on research on whole-tree harvest effects The Forest has compiled and summarized a literature review on the subject of nutrients and whole-tree harvest that is discussed later in this section

Restoration methods to protect soils against nutrient drains include returning slash to the unit, fertilizing, adding land applications of sludge, planting native legumes to restore site nitrogen, or chipping fine slash Prescribed fire can be used within appropriate burn conditions

Another standard related to soil health includes a requirement to keep coarse woody debris on forested sites. Coarse woody debris (woody materials greater than three-inch diameter) is important for maintaining healthy microbial populations that are critical to nutrient cycling, as well as amounts of coarse woody debris remain at a site following management activities It is included in the Forest direction under Biodiversity.

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Suitable Lands and Soil Potentials

Timber suitability depends in part on soil and watershed factors These are described in *Determination of Tentatively Suitable Timber Lands on the Rio Grande National Forest* (Tribble 1993) and in the Timber section of this EIS Soils (landtypes) were removed from the tentatively suitable lands base for two reasons

* Soil mass movement potential (risk of landslides) was rated high

* Soils had poor growing conditions that limited or prevented seedling establishment and growth

About 20,000 acres of forested landtypes was removed from suitable timber lands because of the risk of landslides Landtypes with reforestation problems due to soils having shallowness to bedrock, dry climatic regime, and low available water capacity amounted to 86,530 acres The forested landtypes that remain have stable soils and are considered tentatively suitable for timber management In this way, we assure that ecosystems and soils with known limitations are protected, while timber management activities are allowed on soils more capable and suited for them.

Soil Impacts from Timber Harvest

This section focuses on the effects of conventional and mechanized whole-tree logging systems

Timber harvest can affect soil productivity by heavy-equipment compaction of the soil, the removal of nutrients in tree boles, limbs, and branches; or burning of slash piles when heat alters the soil Heavy equipment on the forested site can result in detrimental puddling, compaction, erosion and displacement Besides these direct effects, damaged soil can lead to increased runoff from lower infiltration rates, sedimentation, lower permeability, and reduced site productivity

The choice of silvicultural systems can affect soil characteristics Clearcutting creates immediate impacts and is generally a one-time event In other systems, such as shelterwood and selection, impacts occur incrementally In shelterwood and selection systems, the designation of skid trails can reduce the cumulative effects of incremental entries into the stand

Timber harvest on the Forest is done by conventional tractor logging or by mechanized whole-tree logging In conventional tractor logging, trees are felled, then limbed and bucked at the stump with manually operated chainsaws A crawler tractor or rubber-tired skidder then drags the logs to a landing, where they are loaded onto a logging truck

In mechanized whole-tree logging (also known as total-tree harvest), trees are felled and bunched by swing-boom or drive-to-tree feller-bunchers Skidders or tractors then skid

bunches of whole trees to roadside landings, where they are limbed, bucked, and stacked for later hauling Limbs, leaves, and other log debris are usually burned at the landing site, though in some instances slash is hauled back into the stand

The "cut-to-length"system is not currently being used on the Forest, but has the potential to reduce impacts on soils In this system, logs are cut, limbed, and bucked by a harvester machine and logs are laid to the side of the skid trail. A "forwarder," which is a haul truck and loader, then picks up the logs and takes them out of the stand The advantages of this system are that slash is left in the stand for nutrient recycling, and the machines operate on top of a slash mat, which reduces fire hazard and soil compaction

Cable systems are also not currently being used on the Forest These systems have minimal effects on soils, because heavy-equipment use is minimized and logs are moved up slopes suspended from cables

Effects on Soil Erosion from Timber Harvest

The amount of soil erosion occurring within a timber sale depends on the amount of bare soil, slope steepness, slope length, inherent erodibility, and rainfall intensity Leaf litter, slash and logging debris reduce erosion because they protect the soil from raindrop impact and present physical barriers to soil movement The greater the amount of bare soil, the greater the erosion potential

The Modified Soil Loss Equation (MSLE) index was used to estimate the effects of timber harvest on erosion for the forested landtype associations (LTAs) Past timber sale monitoring has shown that conventional tractor logging and mechanized whole-tree logging leave about 10 to 20% bare soil The allowable erosion index is shown below in Table 3-52 for the main soils in the LTA, also displayed is the predicted erosion index. Please note that LTA 13, Engelmann Spruce on Landslides is not analyzed, since these ecological units were considered unsuitable for timber production. LTA 5 also includes unsuited lands and was not analyzed. The "allowable erosion index" is the amount of erosion that could occur and still maintain site productivity (Table 3-55)

Table 3-55 Soil Erosion Index by Forested LTAs and Slopes for Timber Harvest Areas

Landtype Association and Major Soil Types (Allowable-Erosion Index)	Erosion Index by LTAs On Slopes of 20%30%35%40%			
LTA 1 -- Engelmann Spruce on Mountain Slopes				
Granile soils (5.0)	1 6	3 2	4 1	5.1
Seitz soils (5 0)	1 4	2 7	3 5	4 3
Leighcan soils (5 0)	1 0	2 0	2 6	3 2
LTA 2 -- Aspen on Mountain Slopes				
Bowen soils (2 0)	0 7	1 5	1 9	2 4
Agneston soils (2 0)	0 2	0 5	0 6	0 8
LTA 3 -- White Fir and Douglas-fir on Mountain Slopes				
Seitz soils (5 0)	1 0	2 0	2 6	3 2
Pergrin soils (2 0)	0 5	1 0	1 3	1 6
Embargo soils (2 0)	1 0	2 0	2 6	3 2

These indices show that erosion rates should be well within allowable limits on all forested LTAs on slopes of up to 35 % The only exception is the Embargo soil, and site-specific analysis would identify specific needs to protect that soil's productivity In general, the upper limit for conventional logging systems is around 35 % For whole-tree harvesting, the upper slope limit for operations is about 50 % (personal communication with J Starnes, Logging Specialist, Region 2-USFS) Logging could occur on these ecosystems without excessive erosion, if bare soil remains at less than 20 % and operations occur on slopes no steeper than 40 %

These indices should not be interpreted as actual erosion rates They are presented to show relative values for estimated erosion limits The analysis identifies situations in which erosion potential could be exceeded if harvest is conducted on steeper slopes Project-level analysis will look at the specific soils in a project and make recommendations to keep erosion rates within acceptable limits

Effects on Soil Nutrients from Timber Harvest

Each logging system has different effects on nutrient balances Nutrient losses from conventional tractor logging are insignificant because tree boles do not contain many nutrients, and tree branches and leaves remain at the stump site. Such losses can probably be replaced by soil weathering and natural inputs, except for some particularly infertile soils (Pritchett 1979)

In mechanized whole-tree logging, however, branches and leaf materials are removed from the site and then burned in large slash piles Removal of branches and leaves can cause two to five times more nutrient loss from the site, since the proportion of nutrients in branches and leaves is much greater than in the boles.

In order for the Forest to evaluate whole-tree logging and its potential effects on soil fertility and productivity, a literature review was initiated about four years ago It is called *A Literature Review of Nutrient Cycling Relative to Logging Systems Including Whole Tree Harvest Systems* and was prepared by the San Juan - Rio Grande National Forests Soils Department (RG Literature Review) In addition to the RG Literature Review, nutrient workshops were conducted that included participation of the timber industry, loggers, environmental groups, FS field personnel, and FS researchers We conducted field trips and developed committees to propose Alternatives and policies on nutrient and slash issues We received a number of comments on the Draft EIS, both favorable and unfavorable toward the slash policy The Forest reviewed many comments and has proposed a new approach that is flexible yet protective of soil fertility for the long term

The Forest also studied the *Literature Review on Nutrient Cycling, Whole-tree Harvesting, Burning Forest Components, and Soil Compaction in Conifer Forests*, by Dr Howard J Woodard of South Dakota University (1993) This project focused on a wider scope of nutrient issues than the Forest review It, like the Rio Grande's, drew on research from around the world, since some of this information can be appropriately applied to the Rocky Mountain area

Woodard's review cites the numerous research efforts and the fact that " there are some conflicting estimates by forest researchers as to the nutrient strain with whole tree harvesting methods " Unfortunately, the Woodard review does not seem to elaborate more

closely on to what extent the research conflicts The RG Literature Review found that although the research conflicts, there is far more evidence suggesting caution than evidence showing few or no effects to long-term productivity from whole tree harvest (WTH)

The RG Literature Review showed some important findings The first was that there is considerable research on the subject of WTH, nutrients and logging residues. Readers are encouraged to obtain a copy of the review and draw their own conclusions on data quantity and specificity Another finding was that most of the research validates the concern that WTH may threaten the long-term productivity of the land, if not properly mitigated

The book *Forest Nutrition Management*, by Dr Dan Binkley,1986, summarized the nutrient concern relative to WTH It stated that " projects have evaluated the impacts of WTH on nutrient cycles and productivity on many sites In most cases, WTH poses a high risk of reduced site productivity within one or two rotations "

The research also indicates that the effects of nutrient removals may be most severe on poor sites (Pritchell,1979, Farrell, 1986, Zinke, 1990) The productivity of Rocky Mountain forests is lower than that of forests in most other regions (Binkley, 1990) Powers and Edmunds (undated paper) state that subalpine forests in North America, of which the RGNF has considerable acreage, rank relatively low in productivity

We sought to determine where the RGNF falls on the productivity scale An analysis of soil productivity was done and compared to the forest productivity classes of the *Timber Resources Planning Handbook*, FSH 2409 13, 8/3/92 The soil productivity classes are based on actual on-site index measurements converted to Yield Capability as well as timber stand data. The results are summarized in Table 3-56 below

The results indicate that RGNF soils are on the mid to lower end of the productivity scale and that statements from Powers, Edmunds, and Binkley appear true This analysis does not mean that timber management should not occur on these soils. Even if they are in lower productivity classes, they are in most cases well suited for timber production without impairing soil productivity The analysis does show that if these are poorer sites, nutrients could be a concern, and necessary mitigation needs to occur to minimize potential nutrient effects

We conducted a more detailed analysis and evaluated the soils on the Forest according to the criteria of the *National Soils Handbook,*

Table 3-56. Soil Productivity Class Distribution on the RGNF

Soil Productivity Class Distribution on the RGNF	
Productivity Class Cubic Feet/acre/year	Acres of Soil Types in Class (% of Forested Acres only)*
Less than 20	*
20 to 49	335,445 (32%)
50 to 84	686,352 (65%)
85 to 119	33,009 (3%)
120 to 164	0
165 to 224	0
225 or greater	0

* Semi-forested types like ponderosa pine, pinyon and juniper do occur in this class but are not considered "forested lands" for the purpose of this analysis
** The acres are based on the extent of soil survey map units

1993 for their Soil Limitations for Total (Whole) Tree Harvest The criteria affecting the soils rating are as follows.

* The thickness, organic-matter percentage, and cation-exchange capacity of the "A horizon." this is a zone of organic-matter accumulation in the mineral soil The thicker this layer, the more organic matter, and the higher the cation-exchange the better the soil rating

* The subsoil Higher cation-exchange capacities are found in soils better suited to store and replace nutrient losses from whole-tree logging

* Effective rooting depth Deeper soils have greater capacity to store and replace nutrients.

* Soil erodibility A ratio of soil factors indicates where higher erodibilities create greater risk

These criteria present a scientific and systematic approach to evaluate soil potentials and limitations, for planning purposes. We evaluated the soils and assigned them ratings of slight, moderate, or severe limitations, based on their inherent properties We then looked at the suitable lands acres by Alternative to see how extensive the concern and mitigation might be Table 3-57 summarizes the results

Table 3-57. Acres of Suitable Lands Rated Severe for Total -Tree Harvest

Category	Acreages by Alternative						
	A	B	D	E	F	G	NA
Acres of Suitable Lands (M) by Soil Types	0	401	329	216	129	291	300
Acres (M) with Severe Limitations for Total-tree Harvest Where Slash Would Remain at the Felled Tree	0	350	288	188	104	256	258
Percent of Suitable Lands Requiring Mitigation	0	87	87	87	81	88	86

Table 3-53 shows that the majority of soils on the Forest rate severe for total-tree harvest, based on full budget levels Soils on the RGNF rate "severe" because, in general, they lack an A horizon or are shallow to bedrock. Nutrients have to come in major part from the direct deposition and decomposition of leaf litter, branches, and other organic materials Mitigation is necessary to minimize excessive nutrient losses caused by whole-tree harvest

In order to prevent potentially damaging nutrient losses, the Forest has worked closely with the Region 2, Regional Office in developing appropriate protection long-term productivity as part of the WCP efforts The Forest has included WCP Standards and Guidelines that protect soil fertility as already discussed in the Resource Protection section These Standards and Guidelines will promote mitigation necessary to protect soil productivity and the important role of organic matter in ecosystem health

Exceptions to leaving slash in place would be based on project analysis If slash must be removed from a site, other appropriate methods would be used to replace removed

nutrients For example, the Forest is allowing whole-tree harvesting so long as slash is returned to the stand when the skidder goes for another log load This allows WTH but achieves desired soil and nutrient conditions. In other instances where forest fuels are determined to be a concern at interface areas, slash treatment techniques or mitigation such as fertilizing, chipping and spreading, lopping, and land applications could be used

It should be emphasized that the above Standard refers to fine slash, which is materials smaller than three inches in diameter. Larger materials, called coarse woody debris (CWD), can still be gathered for firewood without violating this Guideline

Coarse Woody Debris

Coarse Woody debris (CWD) is woody material derived from tree limbs, boles, and roots in various stages of decay It comprises woody materials larger than three inches in diameter

Forested ecosystems evolve with a continual flux of CWD, which performs many physical, chemical, and biological functions CWD protects the forest floor from erosion, protects new seedlings from livestock damage; is wildlife habitat, is a component in stream ecology, and provides shade, moisture, and germination sites for seedlings CWD is also important for releasing nutrients and providing growth sites for *ectomycorrhizae*, which are fungi that help plants take up nutrients (Graham et al , 1994)

The Forest recognizes the importance of CWD and has proposed a Standard that keeps necessary amounts of it on-site, by forest type The tonnages needed on site are minimums, and are based on the research of Graham et al (1994) CWD tonnages are contained in Forestwide direction The Standard applies to "project areas "

The requirement to leave CWD in the forest should not significantly affect firewood gathering, since the proposed amounts of CWD are small compared to the tonnage of materials left after timber harvest.

Effects on Soils from Slash Piling and Burning

When slash is piled and burned at a landing area, the soil may be severely burned Hot fires sterilize the soil biologically and cause changes in physical structure, chemistry, and nutrient content Plants may not return to these sites for many years Burning slash piles causes soil damage that adds cumulatively to other soil damage Burning of fine slash is not allowed unless there is a compelling need in a specific project. CWD can be burned in piles so long as minimum or project-identified levels remain in the stand

Effects on Mass Movement from Timber Harvest

"Mass movement" refers to blocks of earthen and rock materials that slide on a slope from either natural or human-caused phenomena Human-caused mass movements are undesirable because they damage the long-term productivity of the site, leaving raw geologic materials

To protect the soil from mass movement, soil types with high mass-movement potential were removed from the suitable lands base Small slumps and slides (less than 0 10 acres)

may occur because of timber management and road-building activities, but the probability is low

Effects on Soils from Road Building

The road-building activities associated with timber management can affect the soil resource Road construction and reconstruction require that the soil be dug, cut through, and reshaped by heavy equipment When the vegetation is removed and bare soil is exposed, there is an increased chance of erosion

The greatest potential for erosion in timber sales comes from roads The erosion rates for a road surface are highly variable, depending on inherent erodibility, compaction, slope, rainfall factors, slope length, and surfacing Some good indicators of erosion are the road miles of construction and reconstruction and acres affected The greater the miles of road, *the greater the erosion potential Table 3-58 displays the total road miles by Alternative* and the estimated affected acres Note that road miles and acres affected are shown by experienced budget (e) and full budget (f)

Table 3-58 Miles of Road Construction/Reconstruction and Acres of Land Affected in First Decade

	ALTERNATIVES						
	A	B	D	E	F	G	NA
Miles of Roads	0/0	26/118	17/72	13/24	29/51	29/51	16/87
Acres Affected	0	78/354	51/216	39/72	18/51	87/153	48/261

The effects of Alternative A on soils from timber management would be extremely small in area, extent, and duration, since no lands are suitable for timber harvest Some minor impacts might occur due to small, unscheduled harvests for purposes such as wildlife habitat projects, recreation needs, and other small scale projects

Alternative B would have the greatest amount of erosion from roads under full budgets Alternatives NA, D, and G have moderate effects Alternatives A, E, and F would have least amount of erosion from roads under full budget For experienced budgets, Alternatives G and B result in the most disturbance from roads Alternatives NA, D, and E would have moderate effects Alternatives A and F would have the least amount of erosion from roads *since very little timber harvest occurs in these Alternatives.*

Standards and Guidelines in the Plan will be used to mitigate the effects of road construction and maintenance Please refer to the sections on roads and water for additional discussions on impacts and mitigation measures.

Effects on Soils from Fire Management

The Landtype Associations describe the estimated fire frequencies for the various ecological units of the Forest In the past, wildfires burned extensive acreages of the forested LTAs

After these hot burns, the soils were left exposed to erosion, and likely suffered severe erosion to the point of reducing soil productivity A goal is to restore fire to the ecosystem in a way that minimizes soil impacts

There are three fire scenarios that would affect soils over the next planning period. wildfires, prescribed natural fires, and management-ignited fires Wildfires generally produce a small portion of severely burned areas Under all Alternatives, such areas would receive emergency treatments to prevent watershed and soil degradation

Prescribed Natural Fires (PNFs) are naturally ignited and allowed to burn by prescription This means that if conditions are right, the fire would be allowed to burn PNFs have less chance to cause watershed damage than uncontrolled wildfires, because these burns are cooler, and the areas selected have less potential soil effects like lower erosion hazards and lower mass-movement potential If conditions change for the worse, then PNFs could have soil effects similar to wildfire Forest project dollars or other funds may be needed to rehabilitate watershed damage

Management-ignited fires (MIFs) are planned and analyzed prior to ignition MIF programs must be carried out on a temporal and spatial scale compatible with the fire frequencies inherent in the natural ecosystem. This means that burns should not be conducted on the same land at intervals closer than natural fire occurrences This does not mean that large watersheds would be burned and subject to erosion and sedimentation Instead, burns would be scheduled in smaller areas, causing less damage to soils and watersheds.

Fire is a short-term event Between fires, ecosystems grow vegetation that protects soil and water resources The Forest will manage fires so that they are allowed to recur in ecosystems without causing devastating soil losses typical of intense, uncontrolled wildfire

Burning can affect the physical and chemical nature of the soil The amount of soil erosion after a burn depends on the inherent erodibility of the soil, intensity of the fire, the amount of soil exposed, rainfall intensity, length of time the soil is exposed, slope steepness and length, amount of remaining litter and debris, and the vegetative recovery period It can affect vegetation by killing some plants, resetting seral stages to an earlier stage, rejuvenating grass, or contributing to plant vigor by increasing the availability of some nutrients

Fire cannot be restored to every ecosystem without consequences Steep slopes and highly erosive or shallow soils may be significantly impacted if burned. Piling and burning, such as was done in some pinyon-juniper ecosystems in the late 1980s, resulted in severely burned soils that have not revegetated, even eight years after burning The lesson learned is that prescribed fire cannot be conducted everywhere, or haphazardly Environmental Analyses for prescribed fires must include adequate consideration of the effects on soils

Effects on Soils from Recreation

Recreational uses have few impacts on the soil resource (excluding off-road and on-road motorized uses) Camping, trail use, picnicking, mountain biking, and horseback riding cause only localized impacts to soils, in the forms of erosion and compaction These are easily mitigated through soil conservation measures described in the WCP Handbook, and

are expected to be minimal under all Alternatives Specific soil analysis would be done at the project level

Effects on Soils from Minerals Management

Mineral activities are expected to cause soil disturbances of 69 to 216 acres over the next decade, or about 7 to 22 acres per year

Mineral activity impacts on the soil resource would be mitigated through Standard Lease Terms, Stipulations, conditions of approval, operating plans, and prospecting permits. The WCP Handbook mitigation would keep soil impacts within acceptable levels. The overall effect on soils from minerals activities would be relatively small in all Alternatives

Effects on Soils from Travel Management

Road and off-road uses by motorized vehicles have the potential to impact soils adversely by erosion, compaction, and the loss of vegetative cover All motorized travel is restricted to roads and trails The only exception is ATVs allowed off-trail to retrieve game in specified areas of the Forest

-The Forest ID Team conducted an analysis to determine which roads or trails had soil and other resource concerns We identified the most critical resource problems and made recommendations for closing roads or trails if resource conditions warrant As a result, the Forest is proposing to obliterate about 100 miles of roads and trails that have resource problems The 100 miles would directly improve about 350 acres by reducing soil erosion and compaction, and allowing vegetation to reestablish Closure techniques may vary from road to road, but it is essential that soil and water objectives be met in the selected closure method

Travel management Alternatives greatly affect soil productivity Where road and travel management are carefully planned and carried out, the public can continue to have excellent access to the Forest without causing resource problems

ATV use off-road does not cause damage when a few passes occur Once the vegetation has been imprinted by wheels, however, there is an increased likelihood that other vehicles will use those trails, creating resource impacts, including erosion and compaction

Effects on Soils from Range Management

Livestock grazing may affect soil productivity in a variety of ways Under a properly managed grazing system, livestock are well distributed, grasses are grazed only up to a preferred limit, and trailing is minimized There are plenty of grasses left for wildlife and soil protection In addition, livestock recycle important organic matter to the soil that maintains its fertility

When grazing systems are not properly managed, upland and wetland soils may become compacted Excessive grazing reduces vegetation to the extent that soil cover removal is excessive and soils wash away Infiltration is reduced and runoff is increased

An analysis of range conditions on the Forest indicated about 32% of the rangelands are in poor or very poor condition This suggests that allowable soil loss limits are being exceeded in some locations

The primary way to improve these conditions is to remove grazing, or achieve proper utilization of the deteriorated range conditions. With less use, later-seral vegetation will be allowed to reestablish on the site and produce better vegetative cover. Changes in Animal Unit Months (AUMs), timing, pasture rotation, deferment, rest, and allotment closure may all be appropriate means to reduce erosion problems due to grazing.

Watershed Improvements Program

The purpose of the watershed improvements program is to restore damaged watersheds. The following programs are proposed to meet watershed restoration needs The amounts shown in Table 3-59 are based on the emphasis of the Alternative and reflect what would be done under typical (experienced) budget levels.

Table 3-59 Restoration Needs

	ANNUAL RESTORATION NEEDS BY ALTERNATIVE						
AREAS PLANNED FOR RESTORATION	A	B	D	E	F	G	NA
Road Closure to Motorized Travel (Miles)	10	10	10	10	83	10	10
Acres	30	30	30	30	250	30	30
Cost (M$)	60	60	60	60	498	60	60
Other Watershed Needs							
Road Drainage (miles)	38	38	38	38	0	38	38
(Acres)	114	114	114	114	0	114	114
(Cost $M)	21	21	21	21	0	21	21
Soil and Water Land Improvemt Needs							
(Acres)	190	42	55	30	109	55	40
(Cost $M)	95	21	28	15	55	28	20
Road Reconstruction at Stream Crossings							
(Acres)	8	2	2	1	4	2	2
(Cost $M)	40	10	10	5	20	28	20
Annual Total Needs (Acres)	342	188	201	175	363	201	186
(Cost $M)	216	112	119	101	573	119	111
Total Watershed Experienced Budget ($M)	735	283	396	452	679	340	187
Cost of Basic Watershed Admi ($M)	404	200	250	250	250	200	200
Amount Available for Improvent Projects ($M)	331	83	146	202	429	140	-13
Number of Years to Accomplish Needs	7	14	8	5	13	9	*

Soil and water unit costs vary by the type of project For example, the cost of road obliteration for system roads is $6,000 per mile, waterbars on roads and trails cost about $550 per mile Road reconstruction at stream crossings costs $4,000 to $5,000 per crossing Other soil and water improvement work costs about $500 per acre.

The table shows that watershed needs can vary with the emphasis of the Alternative Under some Alternatives, restoration is emphasized more heavily, and therefore costs are greater

Basic soil and water administration costs are variable, as well, since a larger workload requires more personnel to handle the duties. Also note that the budget, which is the amount the Forest would allocate to soil and water, increases with the emphasis When needs and costs are projected, and the basic soil and water administration costs are deducted from the expected allocation, then the remaining dollars are applied directly to watershed work When the remaining dollars exceed the annual need, Forestwide watershed needs could be accomplished in less than the ten-year Plan period. When remaining dollars are less than the annual need, it will take longer than ten years to achieve watershed needs

Under typical (experienced) funding levels, the Forest would achieve its desired condition in the next ten years in Alternatives A, D, E, and G For Alternatives B and F, it would take about 13 to 14 years to achieve desired conditions For Alternative NA as identified by the asterisk, the needs are greater than funds allow, and therefore desired conditions are never achieved

Forest priorities for the next decade are described in the Watershed assessment, which identifies watersheds of particular concern We would use that system of prioritization in focusing on watershed work, while allowing some flexibility for changes that might be needed

CUMULATIVE EFFECTS

Soil effects from major activities in the next decade are shown in Table 3-60. The effects are expressed in terms of experienced and full budget for most items

Table 3-60 Summary of Major Soil Disturbances by Alternative

MANAGEMENT ACTIONS OR PROGRAMS	ALTERNATIVES full/experienced						
	A	B	D	E	F	G	NA
Livestock Grazing (MAcres) [1/]	181/ 181	190/ 190	181/ 181	181/ 181	181/ 181	185/ 185	194/ 194
Timber Mgmt (M(Equiv Clearcut Ac)	0	6 1/ 20 9	4 5/ 16 3	3 7/ 11 5	2 1/ 7 2	4 0/ 12 5	3 9/ 14 9
Roads Const /Reconst (Acres)	0	78/ 354	51/ 216	39/ 72	18/ 51	87/ 153	48/ 261
Minerals Activities (Acres)	69	219	219	219	69	219	219
Trail Construction (Acres)	2	2	2	2	0	2	2
Trail Reconstruction (Acres)	15	30	20	20	15	20	10
Ski Area Expansion (Acres)	1300	1300	1300	1300	1300	1300	0
Campground Expansion/Construction	30	60	40	60	20	20	40
Trailhead Development (Acres)	6	8	6	8	6	6	0
Prescribed Fire M Acres	1 2-4 8	1 2-4 8	1 2-4 8	1 2-4 8	1 2-4 8	1 2-4 8	1 2-4 8
Total Affected Acres (M Acres)	184/ 188	199/ 218	189/ 205	188/ 200	186/ 195	191/ 204	200/ 214

[1/] Unsatisfactory (poor and very poor) range conditions where conditions need to improve

Table 3-60 shows proposed soil disturbance effects by Alternative Alternatives NA and B will likely affect the greatest number of acres Alternatives D, G, and E affect moderate acreages Alternatives F and A disturb the least number of acres, since few projects are proposed

In monitoring timber harvest areas, it is important to consider the cumulative effects of successive harvests that would occur in single-tree selection or in shelterwood Periodic entries may add cumulatively to soil compaction that must be monitored. Designating skid trails will help assure that compaction does not exceed 15 percent

MINERALS

ABSTRACT

There is high potential for the existence of leasable minerals, such as oil and gas, on about 46% of the RGNF During the next ten years, 23 wells could be drilled, including a small field development of nine producing wells near South Fork or Del Norte This would disturb an estimated 129 acres

Locatable-mineral potential is rated high in the historic mining districts of Creede, Bonanza, and Platoro Projected activity would remain at the current levels The Forest would contribute toward domestic needs for energy and important minerals

Mineral activities would disturb about 220 acres during the next ten years This is less than that from a single timber sale

INTRODUCTION

Legal Framework

Many laws and regulations concern mineral activities on National Forest System (NFS) lands

* The *General Mining Law of 1872* set forth the principles of discovery, possession, and other conditions for "hard rock" minerals on lands reserved from the public domain for National Forest purposes

* The *Organic Act of 1897* provided for the continuing right to conduct mining activities on NFS lands

* The *Mineral Lands Leasing Act of 1920* addressed leasable minerals and gave authority to the Secretary of the Interior to lease NFS lands

* The *Multiple-Use Sustained Yield Act of 1960* directed National Forests to consider the relative values of all resources, including mineral resources

* The *Federal On-shore Oil and Gas Leasing Reform Act of 1987* gave the Forest Service (FS) new authority by allowing the FS to conduct a leasing analysis and decide which lands were available and authorized for leasing

Several other laws address mineral activities on NFS lands, only the most significant have been discussed in this section

NFS lands are important storehouses of domestic minerals and energy resources The search for and production of minerals and energy resources are authorized uses of NFS lands, except those lands formally withdrawn from mineral activities by Acts of Congress or by

Executive Authority Mineral activities on NFS lands are facilitated according to the National Mining and Mineral Policy Act and are part of the Forest Service mission

Minerals management is one of the multiple uses of NFS lands Minerals activities are administered through a plan of operations, which includes permits as well as the reclamation and mitigation measures necessary to protect resources

There are three types of mineral resources **Leasable minerals** include oil, natural gas, and geothermal resources, which are made available through lease issuance **Locatable minerals** include hard rock resources such as gold, silver, and copper Rock, gravel, and sand used for construction purposes are **salable minerals** The environmental consequences of the minerals programs by Alternative are discussed in this Chapter

The FS is the surface-management agency and is responsible for protecting surface values during leasable-, locatable-, and salable-mineral activities For salable minerals, the Forest also administers disposal of common-variety minerals such as sand and gravel. For leasable and locatable minerals, the Bureau of Land Management (BLM) manages and makes decisions on the mineral estate and is a cooperating agency in this environmental analysis

The RGNF has taken a proactive approach to public participation during the Plan Revision That participation is documented in Chapter I of this EIS The Forest minerals specialist has consulted with the oil and gas industry and various environmental organizations to define issues, discuss Alternatives, and document concerns This process, called public scoping, continues throughout this analysis and also during specific projects

Domestic oil and gas resources are important nationally because they represent a more reliable reserve of energy than those from foreign sources Oil beneath NFS lands is a future source of onshore domestic reserves, and the U S Geological Survey estimates that NFS lands contain between five and eight billion barrels of undiscovered, recoverable oil, and between 20 and 35 trillion cubic feet of undiscovered recoverable natural gas (Laitos, 1991)

Lease Terms and Concepts Related to Oil and Gas

The following terminology, concepts, conditions, and requirements apply to lease programs

Application for Permit to Drill (APD): This is BLM form 3160-3which operators submit to the BLM when they propose to drill, deepen, or plug back a well hole The lands must be leased before an APD can be submitted

Available Lands. The Code of Federal Regulations states "On completion of the leasing analysis, the Regional Forester shall promptly notify the Bureau of Land Management as to the area or Forest-wide leasing decisions made, that is, identify lands that have been found administratively available for leasing" (36 CFR 228 102 (d)) Thus, after legally unavailable lands and those closed by management direction are subtracted, the remainder of lands are considered "administratively available "

Bonds. Bonds may be collected by the FS to assure resource protection if an operator defaults This is contained in Section 3 of the Standard Lease Terms and is a constant throughout the lease programs

Closed to Leasing by Management Direction. Lands that are not available or authorized for lease by the discretion of the decision-maker Per 36 CFR 228 102 (c) (1) (iii), the leasing analysis shall show on maps those areas that are "Closed to leasing, distinguishing between those areas that are being closed through management direction, and those closed by law, regulation "

Conditions of Approval. Conditions of approval (COAs) are specific management practices included as part of the Application for Permit to Drill The FS selects the practices for site-specific conditions Such practices may include fencing requirements, reclamation measures, water management, hazardous-material management, litter control, and wildlife protection measures

The COAs are not part of this Revised Plan because they are similar to contract specifications, and are too detailed for this programmatic analysis They are available on request from the RGNF Supervisor's Office

Existing Federal Leases. There are no existing leases on the Forest, we chose not to issue new leases until the Plan Revision and leasing analysis are completed The leases on the Forest during the 1980s have been terminated or relinquished, or they have expired

Geophysical Prospecting The use of various scientific techniques and methods to determine likely locations of oil and gas resources The techniques are described in detail in Appendix B of the *San Luis Resource Area Management Plan and Environmental Impact Statement* (USDI, 1989), which is incorporated by reference in this EIS.

Geophysical prospecting is done by permit after a site-specific Environmental Analysis The effects of these activities are very small and are not evaluated in detail Geophysical prospecting does not require a lease

Geophysical prospecting is expected to occur in all Alternatives

Land and Mineral Ownership On the RGNF, the federal government usually owns both the surface and mineral estates These are considered public domain lands

Some lands, however, have federal surface ownership, with the minerals owned by private individuals The FS does not have the authority to issue leases on these lands, because the federal government does not own the mineral rights Federal surface/private minerals lands are unavailable for lease in all lease options The Chama Basin area is a good example of these lands

Sometimes, there are private surface/federal mineral lands within the Forest administrative boundary Through an agreement with the BLM, a cooperator in this process, the Forest has agreed to include these lands in our leasing analysis The Forest cannot make decisions on these lands, however The BLM has the authority to decide the preferred leasing Alternative for these lands, and will make that decision in a separate decision document

Lease Rights. On all leases allowing occupancy, the lessee is granted the right to pursue the development and production of oil and gas resources on that lease, subject to the rights of the lessor

Legally Unavailable Lands. The Leasing Reform Act regulations define these lands

* Lands withdrawn from mineral leasing by an act of Congress or by order of the Secretary of the Interior

* Lands recommended for Wilderness allocation by the Secretary of Agriculture

* Lands designated by statute as Wilderness Study Areas

* Lands within areas allocated for Wilderness or further planning

Legally unavailable lands on the Forest include the Weminuche, South San Juan, La Garita, and Sangre de Cristo Wilderness Areas Any lands allocated to Wilderness by a particular Plan Alternative are also legally unavailable for lease All remaining lands are legally available

Lessor's Rights. The FS, per the Leasing Reform Act, has the right to approve, modify, or disapprove a Surface Use Plan of Operations (36 CFR 228 107 (b) (2) (A more detailed discussion of the denial of operations is found in 55 CFR 10430)

In summary, the discussion says that "leases that are issued for NFS lands should vest the lessee with the right to conduct oil and gas operations somewhere on the lease Accordingly, when a decision is made on authorizing the Bureau of Land Management to offer NFS lands for leasing, it is necessary to ensure that each lease would have development potential." (While it might appear that lease operations could be approved at the time of lease issuance, often by the time such operations are proposed, they might be precluded by a nondiscretionary statute such as the Endangered Species Act) The Forest would deny applications only where unforeseen resource impacts would occur because of nondiscretionary statutes or circumstances

Mineral Potential. The Forest has maps showing areas of high, medium, and low mineral potential (Oil and gas potentials are shown in Figure 3-58) Locatable- and salable-mineral-potential maps are part of the record and can be reviewed at the RGNF Supervisor's Office

Monitoring. The monitoring of oil and gas activities will be conducted under the authority of the Colorado Oil and Gas Commission, the FS, and the BLM The FS will monitor in several ways First, there is the verification process, which occurs before a lease is sold This confirms whether the Stipulations are consistent with actual on-the-ground conditions. If the Stipulations are consistent, then the lease issuance can go on If the Stipulations are not consistent, then a new Environmental Analysis is conducted.

Another type of monitoring occurs when a well is drilled Before construction of the drill pad occurs, FS and BLM personnel inspect the site, adjusting timing and location of the pad to protect resource values Monitoring continues at the well site through production phases, or through abandonment and reclamation, should there be a dry hole

The Reasonable and Foreseeable Development (RFD) scenario and the actual drilling are also monitored If oil and gas development occurs beyond that predicted in the RFD by 10%,

then additional analysis is done The specific monitoring items are included in the Monitoring and Evaluation Plan (See Revised Forest Plan, Chapter V)

Notice for Lands of the National Forest System Under Jurisdiction of the Department of Agriculture. This notice is included with all FS lease proposals It establishes certain authorities for the Secretary of Agriculture regarding the surface management of oil and gas activities (The complete Notice is contained in Forest Plan Appendix G)

Reasonable Foreseeable Development (RFD). Oil and gas regulations require that the leasing analysis identify a "reasonably foreseeable post-leasing activity" or RFD The Rocky Mountain Region of the FS developed the R2 RFD for the RGNF based on the most recent geological data They estimated a potential for about 23 wells over the next decade The BLM also issued an RFD that predicted about 17 wells over the next decade.

To predict the environmental consequences of lease programs, the Forest will use the R2 RFD, since it reflects more current geological data (Both reports are available from the Supervisor's Office on request.)

Staged Decision-Making Process. The Forest makes decisions in stages, as management goes from broad planning decisions to more specific projects Staged decision-making refers to the approach that "an agency is allowed to take incremental steps" (50 CFR 402 14 (k))

The following stages of oil and gas decisions could occur In the initial stage, an Environmental Analysis is conducted to determine the environmental consequences of the proposed Alternatives, including lease options The Deciding Officer selects an Alternative and documents the decision in a Record of Decision (ROD). The ROD says which lands are available and authorized for lease on the RGNF

The next stage of analysis and decision-making occurs when a Surface Use Plan of Operations (SUPO) is submitted with an Application for Permit to Drill (APD) The Forest conducts a site-specific analysis of the proposed well location and the potential effects A decision document is then issued based on the analysis, and the proposed exploratory well drilled

If the exploratory well makes a discovery and two additional wells confirm the field, then another level of environmental analysis and decisions is necessary, to disclose the effects of a field development

Standard Lease Terms. Standard Lease Terms are those conditions and requirements contained on USDI Bureau of Land Management Form 3100-11, Offer to Lease and Lease for Oil and Gas This form describes the rights of the lessee and lessor concerning oil and gas operations It describes rental fees, royalties, and several other terms and conditions Section 6 of Form 3100-11 gives the government the right to protect surface resources (A copy of Form 3100-11 is included in Appendix G of the Forest Plan)

Standard Lease Terms allow other land management activities to occur on the same lands, as long as they do not present unnecessary or unreasonable interference with the rights of the lessee

Stipulations. Stipulations describe specific resource-protective measures and are legally binding attachments to the standard lease form (BLM 3100-11) They are considered part of the lease and consist of three varieties

* A No Surface Occupancy (NSO) Stipulation prohibits any site occupancy.

* A Timing Limitation (TL) Stipulation allows occupancy only during certain times

* A Controlled Surface Use (CSU) Stipulation requires specific conditions to be met in order for a site to be occupied by oil and gas activities.

Stipulations may vary by lease program (The Stipulations for the selected Forest Plan Alternative are presented in Forest Plan Appendix D)

Surface Use Plan of Operations (SUPO). A Surface Use Plan of Operations is a plan for surface use, disturbance, and reclamation of a proposed drill site It is submitted to the BLM with the Application for Permit to Drill, the BLM forwards the SUPO to the FS

Verification. The Leasing Reform Act regulations require a lease process called verification The intent is to make sure that on-the-ground resources are adequately protected with the Stipulations described in the Plan It also assures that potential environmental impacts are adequately described in the Plan EIS

When an oil and gas company expresses interest in a particular parcel of NFS lands, the BLM reviews the FS maps that identify the lands that can be offered for lease, and the Stipulations required for each parcel A report is then sent to the Forest to verify that the lands can be offered and that the Stipulations are correctly applied. (36 CFR 228 102 (e)) It also ensures that operations and development could be allowed somewhere on the lease parcel, unless Stipulations prohibit surface occupancy

If these requirements are met, the BLM is notified that the tracts can be offered If the conditions are not met, then additional environmental analysis is done

Region 2 has developed a standard form to be used in the verification process The form requires that the items mentioned above have been considered. The form is not a decision document, but establishes whether changes are needed or if the Plan and Stipulations are correctly applied

Waivers, Exceptions, and Modifications (WEMs) to the Stipulations. To **waive** a Stipulation means to remove the entire Stipulation from the lease permanently To **modify** a Stipulation means making a permanent change to specific Stipulation provisions An **exception** means a site-specific exemption from a lease Stipulation, but the Stipulation still applies to all other sites within the lease

For the lease programs that require Stipulations, WEMs to the Stipulation may be approved This might occur if new or site-specific information shows a change in circumstances or resource values A WEM could also be granted if the lessee proves that operations can be conducted without causing unacceptable impacts, and that less restrictive measures will protect the public interest WEMs can be granted only following appropriate environmental analysis The option of using WEMs is constant throughout the lease programs

AFFECTED ENVIRONMENT -- LEASABLE MINERALS

A wide range of oil and gas potential exists on the Forest A report titled *Oil and Gas Resource Potential and Projected Exploration and Development Activity in the RGNF, Colorado* (Holm and Dersch, 1994, hereafter called the R2 RFD Report) describes the geology of the Forest and the potential for oil and gas resources The report and oil-and- gas-potential map (Figure 3-89)ere prepared by FS geologists and petroleum specialists of the Rocky Mountain Region

Table 3-61. Oil and Gas Potentials

OIL AND GAS POTENTIAL	ESTIMATED ACRES	PERCENT OF FOREST
No Currently Recognized Potential	659,234	36
Low Potential	146,497	8
Medium Potential	183,121	10
High Potential	842,355	46
TOTAL ACRES	1,831,207	100

The report shows areas of high, medium and low potential, and includes areas having "no currently recognized potential " It also projects the reasonable-and-foreseeable-development (RFD) scenario required by the Leasing Reform Act regulations It is summarized in this document, and the full report is available on request from the Supervisor's Office (The acres of oil and gas potential are shown in Table 3-61, and a map with approximate locations is shown in Figure 3-89)

Leasing interest has been high in the past decade As much as 600,000 acres has been leased in the past over a wide geographic range Leases were issued from near the Conejos River in the south, to near Bonanza in the north Most of the leases have been near South Fork and Del Norte

When the Leasing Reform Act of 1987 was passed, the Forest opted to not issue any more leases until a leasing analysis could be

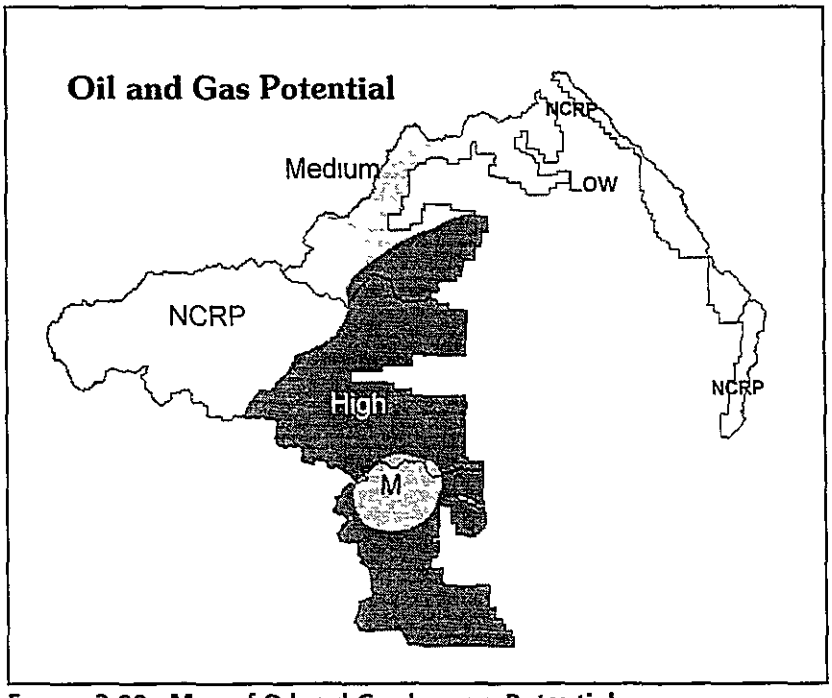


Figure 3-90. Map of Oil and Gas Leasing Potential

completed As of October 1994, all leases had expired, or had been terminated or relinquished

Geophysical activities (techniques used to detect and locate potential oil and gas reserves) have occurred on the Forest About 35 seismic lines have been conducted to locate potential reserves Exploration has been done with magnetic surveys, vibroseis with thumper trucks, and poulter seismic activities Shothole techniques have recently been proposed in the Chama Basin.

The Forest has seen five exploratory wells drilled The Champlin well on Houselog Creek, the Amoco well on the Conejos River, the Meridian well at Willow Creek, the Amoco well at Beaver Mountain, and the Waggoner-Baldridge well at Cedar Springs were drilled during the 1980s. Usually the wells showed hydrocarbon presence but not in producing quantities All the wells have been plugged and abandoned

Of the 600,000 acres leased, only these five exploratory wells were drilled This caused actual disturbance of about 20 acres All the disturbed lands have been successfully reclaimed with grass communities.

ENVIRONMENTAL CONSEQUENCES -- LEASABLE MINERALS

Introduction

The environmental consequences of carrying out various leasing activities are discussed in this section, but also in other resource sections (For example, the effects of the leasing program on water can be found in the Water Resources section)

The following paragraphs discuss the effects of the leasable-minerals program in terms of Effects Common to All Alternatives, Number of Wells Expected by Alternative, Effects from Roads and Pads, Effects on Ecosystems, Description and Effects of Stipulations, Stipulations by Management Prescriptions, Summary of Acres for each Alternative, and Effects and Comparison of Alternatives These sections include direct, indirect, and cumulative effects

Each lease option is part of an Alternative For example, Lease Option A represents the lease option we would implement under Alternative A

All Alternatives, except F, propose to make both the availability and authorization decisions in the Record of Decision for the Forest Plan These are commonly called the "d" and "e" decisions, respectively It is FS policy to make both decisions in the same decision document, on completion of the leasing analysis required in the leasing regulations Alternative F proposes that only the "d" decision be made, deferring the "e" decision until a specific parcel is proposed for lease

The leasing analysis requires the "e" decision to be made for specific lands These are site-specific lands identified down to 40-acre parcels There is some concern that making specific lands decisions in a broad planning document is inappropriate because conditions may change between the time of decision and the time when activities are proposed

Interim Directive 2820-93-1 directs the FS to conduct a site-specific analysis appropriate for making leasing decisions and defer the analysis of appropriate ground-disturbing activity to the next decision stage, the Surface Use Plan of Operations

The Forest has analyzed lands down to 40-acre parcels using the Resource Information System (RMRIS) database, which contains site-specific information on soils, vegetation type, size, and structure, slopes, and other important data The detailed lease maps prepared for this analysis reflect the resource concerns and show Stipulations necessary to mitigate impacts on the surface resources When an actual oil or gas well is proposed for drilling, additional environmental analysis is done and the necessary mitigation is identified to meet the needs of the site If new circumstances arise, adjustments can be made under the Standard Lease Terms, including moving well locations or delaying activities for 60 days If Threatened or Endangered Species are encountered, operations may be denied

Analyzing down to 40-acre tracts is comparable to the detail used to determine the tentatively suitable timber lands for the Forest In both instances, the RMRIS database is the basis for planning decisions

New information may be found during the verification process when a lease parcel is being considered for lease The verification process may identify new or changed information or conditions For example, if, after the "d" and "e" decisions had been made, a bald eagle nest were found on a proposed lease tract, then additional environmental analysis, including public scoping, would be necessary before the tract could be leased

Effects Common to All Action Alternatives

Some effects from oil and gas leasing and activities are common to all Alternatives These effects are described below, and include descriptions of some basic assumptions used in the analysis

Consistency with the Revised Forest Plan. All lease programs were developed to be as compatible as possible with the Forest Plan Goals, Objectives, Standards and Guidelines, Management Prescriptions, monitoring, and land allocations The Forest must also comply with rules and regulations of the Secretary of Interior

Geophysical Exploration. This activity involves the search for and location of potential energy resources We estimate that about 40 acres would be temporarily impacted by geophysical prospecting over the Forest for the next ten years This would include vibroseis techniques and other ground techniques in all Alternatives that make sufficient lands available for leasing

In those Alternatives that restrict or limit the amount of available lands, only five acres would be disturbed by geophysical prospecting, and this would likely occur in the Chama Basin, where private minerals might be developed

Disturbance from geophysical prospecting consists of some compaction from vehicles and short-term disturbances of wildlife, recreation, and livestock grazing These effects are expected to be small, since impacts can be mitigated Project-level NEPA analysis is done when geophysical projects are proposed

Exploratory Well Pad Sizes and Access. Of the 23 wells forecast for the Forest, the R2 RFD estimates 12 exploration wells would be drilled, with one resulting in a discovery. Each well would have a 3 5-acre pad and a newly constructed 0 5-mile access road extending from an existing Forest Road.

This new construction would be side roads, since these are the minimum sizes needed for initial entry to an area Each newly-constructed road would be single-use and gated One well would be drilled per year, except the discovery well, all would be abandoned and reclaimed, including roads and pads Reclamation would include restoring original land contours and native vegetation, unless the Forest decides to keep the road open for administrative use

The exploration wells would occur in various ecological Landtype Associations. On the Divide Ranger District, most LTAs would be affected, including Alpine Grasses on Mountain Summits, Engelmann Spruce on Mountain Slopes; Douglas-fir/White Fir on Mountain Slopes, Thurber Fescue on Mountain Slopes, Arizona Fescue on Mountain Slopes, Sedges and Willows on Floodplains, Western Wheatgrass on Alluvial Fans, Pinon on Mountain Slopes, Ponderosa Pine on Mountain Slopes, and Aspen on Mountain Slopes Roads and pads would be designed away from landtypes devoid of vegetation The Gambel Oak on Mountain Slopes LTA occurs outside the Divide District and is also analyzed

Two exploratory wells are expected in Archuleta and Conejos Counties We estimate one will be in Archuleta Creek, where there are federal-surface with private-minerals lands Geophysical activities have been conducted in this area in the past The exploration well in Archuleta Creek would most likely affect the Engelmann Spruce on Landslides LTA

One exploratory well could be drilled in the Jacobs Hill area, where considerable geophysical exploration has occurred in the past Both the Archuleta and Jacobs Hill wells would likely be dry holes If so, they would be plugged and abandoned Reclamation would occur, including access roads The exploration well at Jacobs Hill would most likely affect the Aspen on Mountain Slopes LTA

Private Surface/Federal Minerals Lands. There are about 7,640 acres of lands within the Forest boundary with this type of ownership Through agreement with the BLM, a cooperating agency in this analysis, the Forest agreed to analyze these lands for leasing Though the FS has no authority to lease them, the BLM does, and will make decisions for these lands

We estimate that of the 23 predicted wells, one could be on these lands. This possibility is included in the Forest's leasing analysis Total estimated soil disturbance would be about 4 8 acres If the BLM decides to make those lands available for lease, and a well is proposed, then the BLM would negotiate the best and most reasonable Alternatives with the surface land owner

RESOURCE PROTECTION MEASURES

Oil and gas exploration and development impacts can be mitigated effectively Mitigation can vary by lease option Descriptions of the types of mitigation, and at what stage they apply, follows

Stage of Development and Mitigation Measures

* Leasing Stage

  Forest Plan EIS and Standards and Guidelines (S&Gs) These describe conditions that must be achieved on the ground The S&Gs direct that resource protection be included in any oil and gas activities

  Forest Plan EIS and Management-Area Prescriptions Prescriptions may contain specific Stipulations to protect resource values

  Standard Lease Terms· Standard Lease Terms include mitigation measures for heritage resources, Threatened and Endangered species, and other resource values

  FS "*Notice for Lands of the National Forest System Under the Jurisdiction of Department* of Agriculture " This requires the lessee to conform with all the rules and regulations governing the use and management of NFS lands It requires a heritage resource inventory, and looking for Threatened and Endangered species before ground-disturbing activities occur Some restrictions may be needed to assure compliance with *the Endangered Species Act*

  Stipulations These are conditions added to the lease to protect resource values. They are a legal part of the lease

  Lease Notices These are information notices applied at the lease stage to forewarn the lessee that certain conditions might exist that warrant special concern

  Verification Process This process occurs before a lease is issued, and assures that resources are adequately described in the EIS, no new information or conditions exist, and occupancy could be allowed somewhere on the lease tract If these conditions are not met, then an environmental analysis would be done to consider the new conditions

* Drilling/Exploration

  Surface Use Plan of Operations (SUPO) This is part of the APD and is approved only after the Environmental Analysis is completed for a specific site Site analysis identifies resource values needing protection and the appropriate mitigation beyond that required by Stipulations The Environmental Analysis identifies "Conditions of Approval" (COAs), which are mitigation measures The COAs are attached to the SUPO

* Field Development

  If an exploratory well were to discover oil or gas, a field development scenario would occur This means an additional Environmental Analysis, with additional mitigation measures identified

* *On-Site Inspections*

  Periodic inspection by Forest and BLM personnel at drilling sites helps assure compliance with mitigation measures

Road Standards

The Forest made assumptions about road standards based on wells previously drilled on the RGNF, and also using information from Appendix C of the *Proposed Resource Management Plan for the San Luis Resource Area* (USDI, BLM 1991) The roads necessary for oil and gas development include two types. Exploratory wells use side roads, while a main service road is needed where field development occurs These roads will be constructed in compliance with Forest Road construction standards

Well Summary

Table 3-62 display the number of wells that could be drilled on the Forest in the next 10- 15 years, based on the full R2 RFD These wells could be in any of the vegetated LTA ecological units

Table 3-62. Well Summary

Total Forest Exploration Wells/Dry Holes	11
Exploration/Discovery/Production Well	1
Total Forest Developmental Wells	9
Total Forest Field-Defining Dry Holes	2
Forest Total (including Split-Estate Lands)	23
Total for Del Norte Area	21
Total for Conejos and Archuleta County	2

Number of Wells Analyzed by Alternative

In some situations, the full projected activity may not be possible or practical because leasing would not be authorized over large areas of the Forest The section below describes to what extent the RFD might occur

Alternative NA: This is the No Action Alternative, which continues current management that allows leasing All 23 wells are analyzed (the full RFD)

Alternative A: Since no lands are administratively available, no leasing could occur Only one well, the Chama well, would occur

Alternative B (with lease options B1 and B2) The full RFD applies and all 23 wells are analyzed

Alternative D: The full RFD applies and all 23 wells are analyzed

Alternative E: The full RFD applies and all 23 wells are analyzed

Alternative F: Few lands are administratively available for leasing. Thus little development could occur Most of the RFD would not occur, except the Chama well that could occur since the minerals are privately-owned

Alternative G: The full RFD applies and all 23 wells are analyzed

Effects on Leasing from the Alternatives

A number of leasing options are available that have been developed to match the intent of the various Forest Plan Alternatives Those Alternatives have been described in Chapter 2 Below are some effects of the different lease Alternatives

Effects on Leasing from Roads and Pads

The environmental consequences of the projected 23 oil and gas wells are shown in Table 3-63 The table presents estimates on the rate and type of oil and gas developments, size of disturbances, miles and acres of roads needing construction, drill pad size, and acres of LTA that would be affected An estimated 4 8 acres per year of reclamation would occur over the ten-year planning period

Table 3-63 shows effects that would occur if the full R2 RFD happens A small amount of lands and ecosystems is affected, compared to other Forest activities For example, a recent timber sale harvested timber on 1,484 acres and required 17 miles of roads, disturbing a total of 216 acres The entire oil and gas program for the next ten-year period affects about 129 acres Of these, 72 are immediately reclaimed since they are dry holes The remainder are reclaimed after the oil field plays out

The creation of 17 5 miles of roads for oil and gas exploration and development has minor environmental effects, if mitigation occurs Since the travel management Alternatives include nearly 100 miles of roads for obliteration, the addition of 17 5 miles is only a short-term increase, while the total Forest road miles decline

Most of the 17 5 miles will be immediately closed and obliterated, since dry holes do not require keeping them open After ten years, only seven miles of new roads would remain open for use

Roads used for oil and gas are single-use roads These roads are intended to reduce impacts to resources and assure public safety

Table 3-63 Summary of Projected Drilling Activity on the RGNF

YEAR	WELL TYPE	LOCATION	PAD SIZE ACRES	MILES OF ROADS	ACRES OF ROADS	TOTAL ACRES	LTA AFFECTED
1	Exploration/Dry Exploration/Dry	Del Norte Archuleta Ck	3 5 2 5	0 5 4 5	1 3 11 7	4 8 14 2	LTA 12 LTA 13
2	Exploration/Dry	Del Norte	3 5	0 5	1 3	4 8	LTA 3
3	Exploration/Dry	Del Norte	3.5	0 5	1 3	4 8	LTA 1
4	Exploration/Dry	Jacobs Hill	3 5	0 5	1 3	4 8	LTA 2
5	Explor/Disc/Prod Development/Prod Exploration/Dry Development/Dry	Del Norte Del Norte Del Norte Del Norte	3 5 3 5 3 5 3 5	0 5 0 5 0 5 0 5	1 3 1 3 1 3 1 3	4 8 4 8 4 8 4 8	LTA 2 LTA 3 LTA 4 LTA 4
6	Exploration/Dry Development/Prod Development/Prod Construction of Main Road	Del Norte Del Norte Del Norte	3 5 3 5 3 5	0 5 0 5 0 5 2 0	1 3 1 3 1 3 9 2	4 8 4 8 4 8 9 2	LTA 1 LTA 5 LTA 6 LTA 5
7	Exploration/Dry Development/Prod Development/Prod	Del Norte Del Norte Del Norte	3 5 3 5 3 5	0 5 0 5 0 5	1 3 1 3 1.3	4 8 4 8 4 8	LTA 6 LTA 8 LTA 9
8	Exploration/Dry Development/Prod Development/Prod	Del Norte [1/] Del Norte Del Norte	3 5 3 5 3 5	0 5 0 5 0 5	1 3 1 3 1 3	4 8 4 8 4 8	LTA 8 LTA 10 LTA 9
9	Exploration/Dry Development/Prod Development/Dry	Del Norte Del Norte Del Norte	3 5 3 5 3 5	0 5 0 5 0 5	1 3 1 3 1 3	4 8 4 8 4 8	LTA 10 LTA 9 LTA 12
10	Exploration/Dry Development/Prod	Del Norte Del Norte	3 5 3 5	0 5 0 5	1 3 1 3	4 8 4 8	LTA 3 LTA 5
TOTALS			79 5	17 5	49 5	129 0	

[1/] This well is on private surface with federal minerals lands

Effects on Ecosystems

Table 3-64 indicates that oil and gas activities have minimal impacts on various Forest ecosystems It assumes oil and gas activities could occur throughout the 13 ecosystems (LTAs), as past drilling has shown The total disturbance of each ecosystem is considerably less than what could occur from wildfires or other large natural disturbances, it is comparable to smaller natural events such as spot fires, insect outbreaks, windstorms, or avalanches The oil and gas disturbances of LTAs would be well within the range of natural disturbances

There are ecosystems that are sensitive to development, and these include the Engelmann Spruce on Landslides (LTA 13) and the Alpine Sedges and Forbs on Alpine Summits (LTA 4)

Alpine ecosystems have shallow soils and vegetation that are sensitive to disturbances. Revegetation potential is poor due to severe climate and erosion hazard that is moderate to high Disturbances could cause irreversible damages A NSO Stipulation will be applied in lease options B2, D, E, F, and G to protect these sensitive ecosystems Lease option B1 does not use any Stipulations for resource protection

Table 3-64 summarizes the total estimated disturbance on the LTAs from the full RFD

Table 3-64 Estimated Acres Disturbed by Oil and Gas Exploration and Development

LANDTYPE ASSOCIATION	ACRES DISTURBED	TOTAL LTA ACRES
Spruce on Mountain Slopes (LTA 1)	9 6	912,000
Aspen on Mountain Slopes (LTA 2)	9 6	40,000
White fir and Douglas-fir on Mountain Slopes (LTA 3)	14 4	95,000
Alpine Sedges and Forbs on Alpine Summits (LTA 4)	9 6	251,000
Ponderosa Pine & Douglas-fir on Mountain Slopes (LTA 5)	14 0	107,000
Pinyon on Mountain Slopes (LTA 6)	9 6	103,000
Gambel Oak on Mountain Slopes (LTA 7)	4 8	2,000
Arizona Fescue on Mountain Slopes (LTA 8)	9 6	120,000
Thurber Fescue on Mountain Slopes (LTA 9)	14 4	108,000
Willows and Sedges on Floodplains (LTA 10)	9 6	65,000
Nonvegetated Areas (LTA 11)	0	48,000
Western Wheatgrass on Alluvial Fans (LTA 12)	9 6	36,000
Engelmann spruce on Landslides (LTA 13)	14 2	37,000
TOTAL	**129**	

The Engelmann Spruce on Landslides LTA has high potential for soil slippage if disturbed Roads for oil and gas access could result in landslides To prevent this possibility, an NSO Stipulation is applied in these areas in lease options B2, D, E, F, and G Option B1 allows occupancy on this sensitive ecosystem

Description and Effects of Stipulations

Appendix G in the Forest Plan proposes new Stipulations that apply to lease options NA, B2, D, E, F, and G Option B1, uses only Standard Lease Terms Alternative A has no leasing, so no Stipulations are needed

Stipulations are part of the lease, and require certain conditions to be met The Forest Interdisciplinary Team developed resource Stipulations so that the resources of the RGNF are sufficiently protected In cases where Stipulations overlap, the more restrictive one applies For example, if a steep slope (of 40% or more--NSO Stipulation) occurs in a Scenic Byway

(CSU Stipulation), then the NSO applies because it is more restrictive For lands administratively available and authorized for lease, the following Stipulations apply to the lease options NA, B2, D, E, F, and G Stipulations follow the uniform format for oil and gas lease Stipulations.

* **No Surface Occupancy for Bighorn Sheep Habitat.** Bighorn sheep exhibit a high fidelity to certain locations used for lambing, feeding, and watering. The Colorado Division of Wildlife has identified these locations The NSO Stipulation does not allow disturbances on these important wildlife sites.

  Oil and gas activities, including field development, could cause impacts to herd calving, movements, and feeding, causing the sheep to relocate to less favorable sites For these reasons, NSO is used to protect these important habitats This Stipulation applies to Management Prescription 5 42, Bighorn Sheep Habitat

* **No Surface Occupancy for Special Interest Areas.** This Stipulation is necessary to protect unique and special areas of historic or cultural importance. This Stipulation is applied to Management Prescriptions 2.1 and 3 1 The NSO Stipulation protects the unique cultural, geologic, scientific, and social values that Special Interest Areas contain.

* **No Surface Occupancy for Watersheds of Concern or High Concern.** This Stipulation is necessary for restoring watersheds that have experienced disturbances. Past management activities have impacted certain areas, causing watersheds to have high total disturbance Major disturbances include activities such as logging, road construction, and livestock grazing The NSO Stipulation prevents additional impacts from occurring in these watersheds until the watershed is improved to acceptable limits This Stipulation is consistent with the proposed Forest Plan, since timber harvest and road building are not scheduled for these areas

* **No Surface Occupancy for Soils with High Mass Movement Potential.** This Stipulation is necessary to protect sensitive soils and ecosystems from mass movement (landslides) This Stipulation prohibits ground-disturbing activity

  Standard lease terms are inadequate because they allow occupancy and associated ground-disturbing activities Any physical disturbances of the surface soils from roads, earthmoving, or pad construction might result in mass movement, a reduction of soil productivity, and increased sedimentation The NSO Stipulation would not allow occupancy and would maintain productivity while allowing leases.

* **No Surface Occupancy for Research Natural Areas.** This Stipulation is consistent with management area prescription 2.2, Research Natural Areas, which emphasizes protection of important natural areas for research and scientific study Activities other than research and study are limited to those that do not destroy the natural vegetation and do not allow roads and facilities

  NSO is appropriate because it will not allow occupancy in these natural areas Standard Lease Terms or other Stipulations are inadequate because occupancy would be allowed, disturbing and affecting the natural functions of the ecosystem Under NSO, leasing is allowed while surface resources are protected

* **No Surface Occupancy for Alpine Ecosystems.** Alpine areas are defined by Landtype Association LTA 4, Alpine Sedges and Forbs on Alpine Summits This LTA occurs on high-elevation tundra areas having sedges, forbs, and shrub vegetation on shallow soils. The soils are strongly acid and have poor revegetation potential due to shallow rooting depth This ecological unit is in a harsh climatic regime characterized by high winds, cold temperatures, 30 to 50" of precipitation per year, and a very short growing season

  NSO is the most appropriate Stipulation to protect these fragile ecosystems Surface disturbances of any kind would be difficult, if not impossible, to reclaim

* **No Surface Occupancy for Backcountry, Backcountry Nonmotorized, Backcountry Motorized.** *This Stipulation is applied to areas allocated to*

  * Management Prescriptions 1 31, 1 32 - Backcountry Nonmotorized Recreation
  * Management Prescription 3 31 - Backcountry Motorized Recreation
  * Management Prescription 3 3 - Backcountry

  Backcountry prescription areas are generally unroaded and natural-appearing, with little evidence of recent human-caused disturbance NSO is the most appropriate Stipulation to protect these backcountry values

  Surface disturbances of any kind would affect the nature and recreation potential of these areas Standards lease terms, CSU, or TL all allow occupancy, so would not protect the backcountry experience NSO allows these lands to be leased, while protecting and maintaining them in an undeveloped setting NSO is consistent with the proposed Forest Plan, which emphasizes areas that are natural-appearing with little or no evidence of recent human-caused disturbance The NSO Stipulation is compatible since the aim is to provide recreation near the primitive end of the Recreation Opportunity Spectrum

  Prescription 3 31 allows some motorized uses on low-standard roads that are often steep or require 4-wheel drive To allow occupancy for oil and gas development would require building higher standard roads, these would change the backcountry nature of these areas

  No Surface Occupancy for Ski Resorts. This Stipulation is consistent with Management-Area Prescription 8 22, Ski Resorts NSO is the appropriate Stipulation because the mineral estate is available to be leased, while the integrity of the ski area as a recreational place is maintained throughout the four seasons

  Standard lease terms, TL, and CSU allow occupancy, and may create conflicts with four-season use or summer maintenance activities

  No Surface Occupancy for Slopes of 40% or More. This Stipulation is consistent with the proposed Forest Plan, which has goals of maintaining soil productivity and protecting water quality

  This Stipulation is not defined by Management-Area Prescriptions because steep slopes may occur anywhere on the Forest Potential visual impacts are also reduced by this

Stipulation, since many steep slopes would require full-bench road construction that is highly visible Soil erosion often exceeds tolerable amounts on slopes of 40% or more.

Timing Limitation for Deer/Elk Winter Range. This Stipulation is necessary so that deer and elk herds are not disturbed during the critical winter period, from December 1 through April 15

This Stipulation would be applied to all lands allocated to Management Prescription 5.41 Standard Lease Terms alone would not allow adequate times for protection of the elk winter range Occupancy of these area is allowed between April 16 and November 30, when the animals have migrated to summer range higher in the mountains

It should be acknowledged that if field development were to occur on timing-stipulated areas, occupancy would be allowed in a way that would reduce disturbances of wildlife An EIS would be needed for field development, and appropriate mitigation would be set up through that process

Controlled Surface Use for Soils with Moderate Mass-Movement Potential Areas mapped with this Stipulation have a moderate mass-movement potential, which means they may be subject to landslides, earthflows, debris avalanches, and block slippage

Because of this possibility, occupancy (drill pads and access roads) will be allowed only after an on-site review by soil, water, and engineering specialists The specialists may approve the proposed location or require a new one This Stipulation is necessary because proposed well locations may need to be moved more than 200 meters to reduce mass-movement risks

The CSU Stipulation is consistent with Forest Plan Goals, which are to maintain soil productivity, ecosystem sustainability, and water quality NSO is overly restrictive, since many locations within the stipulated area can have occupancy Standard Lease Terms are inappropriate because they do not describe the specific restrictions for development

Controlled Surface Use for Scenic Resource Areas These areas have high scenic and recreational values that may require screening, buffering, or site relocation within the lease to meet landscape character

Relocation of proposed well sites may require distances greater than 200 meters. Standard Lease Terms allow relocation up to 200 meters. NSO would be too restrictive, since scenic areas can contain management activities A computer-generated perspective may be required as part of the visual impact assessment In addition, an on-site investigation by a qualified landscape architect is required as part of the site-specific environmental analysis.

This Stipulation is applied to the following areas, unless a more restrictive Stipulation applies

* Management Prescription 4 3 - Dispersed Recreation
* Management Prescription 4 21 - Scenic Byways
* Management Prescription 3 4 - Scenic Rivers

* Management Prescription 4 4 - Recreation Rivers

Stipulations by Management Prescription and Alternative

Management prescriptions contain Standards and Guidelines specific to the prescription emphasis Oil and gas Stipulations are tailored to the theme of the prescription and the Alternative For example, Backcountry Nonmotorized Areas (1 31 and 1 32) could be leased under Standard Lease Terms only, or Standard Terms plus Stipulations, or could be closed to leasing, depending on the Alternative

With Stipulations, the unroaded character is protected, while occupancy could be allowed without Stipulations Table 3-59 shows how the Stipulations vary by management prescription and Alternative for all legally available lands Management prescriptions 1 11, 1 12, and 1.13 all apply to Wilderness areas, which are legally unavailable for lease, so are not included in the table Areas recommended for Wilderness (1 2) are also legally unavailable and not included

Table 3-65. Lease Stipulations for Legally Available Lands by Management Prescription and Lease Option

MANAGEMENT AREA PRESCRIPTION	LEASE OPTION AND STIPULATION							
	A	B1	B2	D	E	F [v]	G	NA
1 31,32 Backcountry, Nonmotorized	CLOSED	STD	NSO	NSO	CLOSED	NSO	-	NSO
1 42 Core Area Restorat on						CLOSED		
1 5 Wild Rivers (eligdesig)		STD	CLOSED				DNL	
2 1 Special Interest Areas	CLOSED	STD	NSO	NSO	CLOSED	CLOSED	NSO	NSO
3 1 Special Interest Areas	CLOSED	STD	NSO	NSO	CLOSED	CLOSED	NSO	NSO
3 21 Limited Use Area		-	-	-	-	CLOSED	_	-
3 22 Limited Use Area/Rest						CLOSED		
3 31 Backcountry, Motorized	CLOSED	STD	NSO	NSO	CLOSED	NSO	-	NSO
3 55 Wildlife Corridor		-				CLOSED		
4 21 Scenic Byways and/or Railroads	CLOSED	STD	CSU	CSU	CLOSED	CSU	CSU	
4 4 Recreation Rivers	CLOSED	STD	CSU	CSU	CSU	CLOSED	CSU	CSU
5 13 Forest Products		STD	STD&	STD&	STD&	-	STD&	STD&
5 41 Deer/Elk Winter Range	CLOSED	STD	TL	TL	TL	TL	TL	TL
6 1 Grassland Production	CLOSED	STD	STD&	STD&	STD&	-	STD&	STD&
8 22 Ski Resorts	CLOSED	STD	NSO	NSO	CLOSED	NSO	NSO	NSO

Summary of Acres for Each Forest Plan Alternative

Table 3-66 presents the status of lands by lease category It summarizes what lands are available and authorized for lease by Alternative, including what Stipulations are applied and the associated acres It also shows other lands status where the Forest has no leasing authority The table is useful for comparing Alternatives

Table 3-66 Lease Category and Stipulation Acres by Lease Option

LEASE CATEGORY	LEASE OPTION							
	A	B1	B2	D	E	F	G	NA
Lands Legally Unavailable for Leasing								
Wilderness, Rec Wilderness *(Includes Chama Basin)*	940,657	450,166	450 166	450,166	555,117	630,095	450,166	453,337
% Forest Leg Unavailable	51	24	24	24	30	34	24	24
Lands Legally Available for Leasing								
% Forest Legally Available	49	76	76	76	70	66	76	76
RGNF Lands Analyzed for Lease	All	All	All	All	All	46%	All	All
Lands Closed to Leasing by Management Direction (Discretionary No Lease lands)								
Acres	*916,100*	*0*	*0*	*860*	*518,626*	*412 027*	*267,405*	*708,363*
Lands Administratively Available and Authorized for Lease								
Acres Leased with NSO	0	0	741,746	837,907	270,051	112,324	585 575	128
Acres Leased with TL	0	0	145,313	134,966	151,017	57,711	134,955	0
Acres Leased with CSU	0	0	97 390	91,249	38,126	25,435	92,522	0
Acres Leased with Std Lease Terms	0	1,406,591	422,142	341,609	323,820	45,755	326,134	694,929
Total Forest Lands	1,856,757	1,856,757	1,856,757	1,856,757	1,856,757	1,856,757	1,856,757	1,856,757
Lands with Private Surface/Federal Minerals -- BLM Makes Lease Decisions								
Acres	7,640	7,640	7,640	7,640	7,640	7,640	7,640	7,640

Effects and Comparison of Alternatives, Including Lease Options

Lease options are part of the Alternatives They vary in process, resource protection, and decisions made This section describes the major differences in the leasable minerals program by Alternative

Alternative NA includes lease option NA This is the No Action Alternative, so the 1985 Plan allocations apply A new set of Stipulations (see Plan Appendix D) would apply, however, since the 1985 Stipulations are outdated No Wilderness is legally available for lease Outside Wilderness, no lands are closed to leasing The full RFD occurs and 23 wells are developed over the next decade, disturbing about 129 acres in all LTAs Both "d" and "e" decisions are made If the BLM selects this Alternative, they would lease the private surface/federal minerals lands with the new Stipulations

Alternative A includes lease option A, and conforms with Forest policy by making both the "d" and "e" decisions Under this Alternative, ecosystems are perpetuated, while human uses are subordinate and few commodities produced No lands are available or authorized for lease

This lease option is not consistent with FS policy, which is to facilitate development of the mineral resource as a part of multiple-use This leasing option is consistent with other resource management in the Alternative, because no lands are suitable for timber, few roads are constructed, livestock grazing is de-emphasized in favor of wildlife, and mineral withdrawals are proposed for large areas Only the Chama well could be drilled, resulting in about 14 acres of disturbance of LTA 13 No other wells will be drilled, since no lands are available or authorized for leasing

Alternative A recommends considerable acres as Wilderness, which are legally unavailable for leasing Remaining lands are closed to leasing by management direction for perpetuation of ecosystems

The BLM would not lease any of the private surface/Federal minerals lands if they select this Alternative

Alternative B includes lease options B1 and B2 Alternative B emphasizes commodity production and economic stability, while perpetuating ecosystems. Lease options B1 and B2 are consistent with this emphasis and authorize all legally available lands for lease. No areas are recommended for Wilderness

The main difference between lease options B1 and B2 is the way effects on resources are mitigated B1 uses only the Standard Lease Terms (described previously) in protecting resource values These lease terms require that operations are conducted to reduce adverse impacts on the land, air, water, heritage, biological, scenic, and other resources, and to other land uses and users This language allows for a wide range of adjustments in location and timing of oil and gas activities on the lease parcel. It gives the Forest the authority to move proposed locations out of wetlands and riparian areas, away from cultural sites, away from Threatened, Endangered, or Sensitive species, or any other relevant resource concern

B1 does not use Stipulations for resource protection Standard Lease Terms allow occupancy somewhere on the site, so that some resource concerns might be compromised. For example, unroaded areas available and authorized for lease could be developed with roads and oil and gas facilities The following areas could be occupied and developed Research Natural Areas, ski areas, wildlife winter range, scenic byways, Special Interest Areas, special wildlife areas, eligible wild, scenic and recreation rivers, alpine ecosystems, steep slopes, areas with moderate to high mass movement potential.

Lease option B1 would result in some impacts on other resource values. If, for example, an exploratory well were drilled in an unroaded area and a field developed, the unroaded character would be lost Alpine areas could be drilled, creating visual impacts that are not easily mitigated In addition, soil revegetation potentials for alpine areas are rated poor and these areas are extremely difficult to restore after disturbances There is a reasonable chance that these areas might not recover for many decades

Mitigation is accomplished under the Standard Lease Terms This allows the BLM and FS to adjust the location or timing of oil and gas activities For example, if a proposed well were located in a wetland or riparian area, the FS could move the location to an upland site, protecting the riparian resources. Well drilling could be delayed for 60 days or more, if necessary

The BLM would lease all of the private surface/federal minerals lands if they select this Alternative They would use Standard Lease Terms alone to protect resource values

Standard Lease Terms have the disadvantage of not clearly identifying the resources of concern at the Plan level Instead, all resource concerns are identified at the project level Prospective lessees might bid successfully on a lease tract, but then be restricted by on-site conditions that became known when the site was staked

All Forest Standards and Guidelines, including those in management area prescriptions, apply to this lease option If this Alternative is selected, then all references to Stipulations in Management Prescriptions and general direction will be removed

The full R2 RFD, described earlier, occurs

Alternative B with lease option B2 makes all legally available lands administratively available and authorized for leasing This includes all lands outside designated Wilderness However, under B2, lease tracts are appropriately stipulated to protect specific resource values The full 23 wells could occur

Backcountry areas are protected with the NSO Stipulation These areas could be leased, but oil and gas activities could not occur on them Instead, directional drilling from adjacent areas is allowed, which protects the area's unroaded characteristics Similarly, existing Ski Areas, Special Interest Areas, Research Natural Areas, special wildlife areas, damaged watersheds, eligible wild rivers, alpine ecosystems, slopes of 40% or more, and landtypes with high mass-movement potential are all protected by the NSO Stipulation

A Timing Limitation Stipulation protects wildlife winter range The Controlled Surface Use Stipulations would be applied to dispersed- recreation areas, scenic byways, eligible scenic and recreation rivers, as well as on landtypes having moderate mass-movement potential These Stipulations alert the lessee that special siting adjustments may be necessary to mitigate effects to visual or recreation resources, or to reduce mass-movement risks This allows the lands to be leased while mitigating potential conflicts with other resource concerns

All other lands are available and authorized for lease under the Standard Lease Terms Riparian areas are avoided and any proposed well location would be moved by the FS to upland sites The vast majority of riparian areas are narrow, and the 200-meter (600 ft) measure easily protects the health of those ecosystems Riparian areas are specifically protected under the leasing regulations

The BLM would lease all of the 7,640 acres of private surface/federal minerals lands with Standard Lease Terms and Stipulations, if they select this lease option For B2, most of the 7,640 acres are leased with timing Stipulations to protect winter range

For B1 and B2, all potential areas for oil and gas (high, medium, low, and NCRP) outside of Wilderness are available and authorized for lease This keeps open the option of exploring some lower-potential areas for energy resources.

Under B1 or B2, the RGNF could contribute toward domestic energy needs. B2 would also provide additional mitigation measures (stipulations) so that another level of resource protection would be provided Both lease options are consistent with Leasing Reform Act regulations, the Mineral Policy Act, the mission of the FS, and the proposed Standards and Guidelines Both programs support local, Regional, and National economies to some extent by allowing opportunities for development. There is the potential for the Forest to contribute to National energy needs and provide economic benefits

Alternative D with lease option D makes most of the Forest lands available and authorized for leasing. The Forest does not, however, allow leasing (by management direction) on 860 acres of eligible Wild River corridors This is because mineral activities are not compatible with Wild River qualities and values. NSO is inadequate because a lease creates an encumbrance, and may complicate designation of the river Otherwise, the Stipulations described in B2 are applied to protect resource values The full 23 wells could occur under this Alternative

The Stipulations described in B2 include resource protection standards Alternative D has different land allocations than B2, so the areas where the Stipulations apply are likely to be different

The BLM would lease all of the 7,640 acres of private surface/Federal minerals with standard terms and Stipulations if they select this Alternative There are no eligible Wild rivers near these lands, so there is no reason to close these lands to leasing Most lands are leased with a timing limitation to protect wildlife winter range

Alternative E emphasizes recreation and contains lease option E This option proposes to not allow leasing on most recreation prescriptions to avoid potential conflicts with recreation user groups and limit visual impacts The Forest will Close Backcountry Areas, Dispersed Recreation Areas, Existing Ski Areas, Scenic Byways, Special Interest Areas, and eligible Wild rivers to leasing The full 23 wells could occur under this Alternative

The NSO Stipulation applies to special wildlife areas, research natural areas, watersheds of concern, alpine ecosystems (LTA 4), slopes of 40% or more, and high mass movement potential areas A TL Stipulation applies to wildlife winter range as described in option B2

The CSU Stipulation is applied to eligible Scenic and Recreation rivers This Stipulation is applicable because mineral leasing and operating plans are generally considered compatible with the management of these rivers. CSU is applied to landtypes having moderate mass-movement potential

All other lands are available and authorized for lease under Standard Lease Terms Riparian areas would be avoided, and any proposed well location within a riparian area moved to upland sites as discussed in option B2.

The BLM would make most of their lands available and authorized for lease About 7,440 acres would be available for lease, with 200 acres near East Butte, just east of English

Valley, closed to leasing These lands are included in Forest lands managed as a botanical area, which are unavailable for lease All other lands are available for lease with timing limitations to protect winter range

Alternative F with lease option F makes few of the Forest lands available and authorized for leasing Lease option F analyzes only lands having "high" oil and gas potential Other lands with little potential result in no decision as to availability or authorization until interest is expressed in a specific parcel, when a site-specific environmental analysis would occur

By management direction, this lease option closes the following to leasing core areas, core reserve restoration Areas; Limited-use Areas, Limited Use Restoration Areas, Special Interest Areas, Research Natural Areas, Eligible Wild, Scenic, and Recreation Rivers

NSO Stipulations are applied to backcountry areas, existing ski areas, special wildlife areas, alpine ecosystems (LTA 4), slopes of 40% or more, and areas with high mass movement potential A TL Stipulation is applied to winter wildlife range, as described in option B2 Dispersed recreation areas, scenic byways, and landtypes having moderate mass-movement potential all have CSU Stipulations

The BLM would make their lands available for lease They will only lease lands only after interest in a parcel is expressed and additional environmental analysis completed All 7,640 acres of private surface/federal minerals lands are available for lease, except 200 acres near East Butte and 520 acres near Old Woman Creek, sections 3 and 4 The Alternative designates these areas as core reserves and Special Interest Areas where no leasing is allowed. All other parcels could be leased under TL Stipulations to protect winter range.

Since only a small amount of the legally available lands are administratively available for lease, the full RFD could not occur The Chama well is expected to occur, but the other 22 wells would not

Alternative G with Lease Option G makes most of the Forest lands available and authorized for leasing By management direction, however, the Forest does not allow leasing on eligible Wild River corridors and unroaded areas outside locations with high oil and gas potential.

For example, an unroaded area with high oil and gas potential could be leased under a No Surface Occupancy Stipulation. This would allow for directional drilling underneath such areas, while maintaining the unroaded character of the area Unroaded areas in lower potentials are closed to leasing, since the chance for oil and gas resources is reduced

Otherwise, the Stipulations described in B2 are applied to protect resource values The full 23 wells could occur under this Alternative

If BLM adopts this Alternative, it would lease all of the 7,640 acres of private surface/federal minerals lands, with standard terms and Stipulations There are no eligible Wild Rivers near these lands Based on review of maps, all of the BLM-administered lands occur in high oil and gas potentials, so none would have to be closed to leasing if in an unroaded area

AFFECTED ENVIRONMENT -- LOCATABLE MINERALS

Locatable minerals are those valuable deposits subject to exploration and production under the U.S General Mining Law of 1872 and its amendments. Locatable minerals are called "hard rock" minerals and may include deposits of iron, gold, silver, lead, zinc, copper, and molybdenum

By law, citizens have the right to explore for, claim, and mine mineral deposits on federally owned lands, subject to the U S Mining Law Through an agreement with the BLM, the FS administers mining activities on Forest lands The FS approves and administers exploration and mining through Operating Plans, to assure reclamation and protection of other valuable surface resources

Past locatable mineral production was concentrated in the mining districts of Platoro, Carson, Jasper, Spar City, Summitville, Creede, and Bonanza Gold and silver were the dominant minerals, but most ores also contain lead and zinc, with some copper. Of the major mining districts on the Forest, none are active today, except for reclamation efforts at Summitville and Bonanza.

Historic mining has left a complicated legacy Most of it occurred before the establishment of the Forest As claims were worked, processed, and then abandoned, several environmental and physical hazards were left on the landscape The responsibility to perform has vanished with the previous generations

The State Geological Survey, with federal funds, has been conducting inventories of abandoned mine land on the Forest The Bonanza area is the Forest's priority for reclamation, because of the many hazards there Other priorities will be set after Bonanza is completed and will be reclaimed as funds become available

The Summitville Mining District is currently undergoing large-scale reclamation Summitville was recently the site of a high-elevation heap-leach gold operation conducted on private lands by Summitville Consolidated Mining Company Only 20 acres (of the 1,200 acres) of Forest lands were affected by the mine The mining company declared bankruptcy in 1992, causing the federal government to seize control of the operation. Private lands such as these are regulated by the State Department of Minerals and Geology Efforts to clean up the area will continue during the duration of this Forest Plan.

Major reclamation efforts to clean up the historically mined waste dumps, tailings piles, and hazards are occurring in the Bonanza area The responsible parties have organized to clean up the waste piles and restore environmental integrity to the Kerber Creek drainage, with oversight from the FS, State Department of Health, and other State agencies

The Forest administers about four operating plans per year Operations include exploration and development of gold, silver, copper, and other precious metals The Forest has maps showing areas of low, medium, and high potential for locatable minerals Table 3-67 displays the estimated acres of each potential category It is likely there will be continued interest in exploring and developing the Forest's locatable mineral resources

All public domain lands (where the federal government owns the minerals) are available for development of locatable minerals, except Wilderness Areas and withdrawn areas. (Some valid and existing rights are still present in Wilderness Areas)

Most FS facilities are withdrawn from locatable-mineral entry, as are Special Interest Areas such as Wheeler Geologic Area and the crystal beds on the Saguache District The Chama Basin is unavailable for locatable minerals, because the mineral rights were reserved from the federal government

Table 3-67. Locatable Mineral Potential

LOCATABLE MINERAL POTENTIAL	ESTIMATED ACRES	PERCENT OF FOREST
Low Potential	1,281,845	70
Medium Potential	320,461	18
High Potential	228,901	12
TOTAL	**1,831,207**	**100**

ENVIRONMENTAL CONSEQUENCES -- LOCATABLE MINERALS

To help analyze cumulative effects, the following estimates show the amount of land disturbance that might occur over the next planning period from hard rock minerals We will use the previous year's numbers as a basis for the estimates for the next ten years

Number of Operating Plans Expected over Next ten Years	Miles of New Roads Constructed for Mining Activities	Total Acres Disturbed by New Roads and Mining Activity
40	4	40

RESOURCE PROTECTION MEASURES

The 1872 Mining Law regulations (as amended) require the mining claimant to file an operating plan or notice of intent for proposed mining activities The plan must include the name and address of operators, a sketch or map of the location, descriptions of operations, access, timing, operating period, and environmental-protection measures The Forest would work with the claimant to assure that Standards and Guidelines in the Forest Plan are carried out The Operating Plan requires an Environmental Analysis and decision before the plan is approved

These regulations require the FS to respond to the claimant's operating plan in a timely manner Operating plans cannot be denied, though the FS may request additional time for environmental analysis and on-site inspections Additional-time requests cannot go more than 60 days past the initial 30-day response period

Effects of Mineral Withdrawals

Mineral withdrawals are used to protect resource values from impacts of hard rock mineral extraction and development, where normal mitigation would not preclude effects Mineral withdrawals are considered for areas with a history of mineral findings and where management direction is not compatible with use under the mining laws. For example, Research Natural Areas, interpretive or heritage sites, scenic areas, critical habitat, botanical areas, and capital improvements would be withdrawn

Withdrawals must be applied for through the Secretary of Interior All withdrawals are subject to valid existing rights at the time of withdrawal

Each Alternative proposes various acreages for withdrawals These proposals are consistent with the intent of each Alternative to protect resource values Table 3-68 shows the acres proposed for withdrawal by Alternative

Figure 3-68. Summary of Withdrawals

	ALTERNATIVE						
	A	B	D	E	F	G	NA
Recommended for Wilderness [1]	506,158	0	0	104,950	197,713	0	0
Backcountry (Rx 1 31, 1 32,3,3)[2]	0	59,449	66,697	79,565	44,183	0	0
Core Areas	0	0	0	0	470,569	0	0
Limit Use Areas	0	0	0	0	184,088	0	0
Corridors	0	0	0	0	57,301	0	0
RNA's Outside Wilderness	6,179	10,813	10,813	10,813	7,073	10,813	0
Wild Rivers	2,872	2,979	2,979	2,979	460	567	0
Total Acres for Withdrawal	515,209	73,241	80,489	198,307	961,387	11,380	0
Acres Already Withdrawn as Wilderness	430,253	430,253	430,253	430,253	430,253	430,253	430,253
Remaining Lands Available for Locatable Minerals Activities (% of RGNF)	49	73	73	66	25	76	76

1/ Areas recommended for Wilderness would require Congressional action Those areas would be withdrawn, pending Wilderness legislation
2 Only those backcountry areas having high locatable-mineral potential

Backcountry nonmotorized areas are proposed for withdrawal in Alternatives B, D, E, and F if they have high locatable-mineral potential This is because there is little risk of development in an unroaded area having low mineral potential. Conversely, risk of development is high in areas of high mineral potential In order to protect backcountry values, these areas were proposed for withdrawal

One of the consequences of proposing large withdrawals is that a number of costly analyses have to be completed regarding mineral potential The withdrawal must then receive Congressional approval, which could entail considerable debate

Alternative G does not propose withdrawals for the large blocks of unroaded areas This Alternative would place those areas at risk of development, though the Forest can still regulate and determine reasonable access to mineral claims Based on current and recent mineral activities on the Forest, however, the risk of any unroaded area having new mineral activities is small

Alternative F is different from the other action Alternatives in that not just high mineral potential areas are proposed for withdrawal All acres in Core Reserves (Prescriptions 1 41 and 1 42), Wildlife Corridors (3 55), and Limited Use Areas (3 21, 3 22) are proposed for mineral withdrawal Therefore, the total acres for withdrawal are the total acres for those Prescriptions

Research natural areas (RNAs) were evaluated to determine if there are valid existing mining claims in them Based on analysis of the "Geographic Index" (August 1994), a listing of existing and closed mining claims for a given area, only the Finger Mesa RNA has currently existing mining claims All other proposed RNAs have claims listed, but all are closed cases, meaning that the claim is no longer valid

All RNAs are proposed for withdrawal from locatable-minerals entry This does not mean that such areas are closed to leasing, since oil and gas resources could be developed from adjacent lands through directional drilling The Finger Mesa RNA could be proposed, if the claimant chose to develop, a mineral examination would be necessary The Finger Mesa area has low potential for locatable minerals, however, so the risk of development is low

Other areas have low potential, as well Mill Creek has medium potential, but no existing claims This means that withdrawals could occur, though some mineral potential would be an opportunity cost Deadman Creek has medium potential but is designated Wilderness No claims exist in the Deadman RNA. The North Zapata area is in medium potential, and in designated Wilderness Hot Creek is in low potential, outside Wilderness, and has no claims Spring Ranch has low potential and no existing claims

Wild Rivers, outside Wilderness, would be proposed for withdrawal Special Interest Areas would have portions withdrawn to protect the special features of those areas

In summary, Alternative F proposes the greatest amount of withdrawals, leaving only 25% of the Forest available for locatable-mineral activities Alternative A has a large amount of lands recommended for Wilderness, and would leave 49% available Alternatives NA, B, D, E, and G are similar, and would make between 66 and 76% of the Forest available

Effects of Recreational Panning, Sluicing, and Dredging

Recreational mineral collection, using metal detectors, panning, dredging, and sluice-boxes, occurs on the Forest Recreational mineral collection is different from mining for commercial purposes in size and associated environmental impacts The Forest has included a guideline developed by the FS Rocky Mountain Regional Office that states "Recreational panning, sluicing, and dredging shall be allowed outside Wilderness where such activities do not interfere with the rights of mining claimants protected under the 1872 Mining Law These activities shall be evaluated on a case-by-case basis, to determine if an operating plan is needed, by the authorized Forest Service official " This Guideline is necessary because of the growing interest in recreational panning and the need for a consistent policy Panning and

other recreational forms of mineral collecting are still subject to the 1872 Mining Law Wilderness Areas are specifically withdrawn from all forms of mineral appropriations Panning, however small in impact, would extract minerals from Wilderness Areas if this guideline were not developed

Panning is allowable on other parts of the National Forest not withdrawn and respective of existing claims Nationwide, the Army Corps of Engineers has issued 404 Permit guidelines to reduce water impacts. Recreational mineral collection is expected to increase over the coming years

Effects of Abandoned Mine Lands

The State Geological Survey is inventorying the nature, types, and extent of abandoned mines that were developed before establishment of the NFS Abandoned mines will undergo restoration as funds allow As part of the Planning budget proposals, monies are proposed under trust funds for the restoration of physical and environmental mine hazards Even under the proposed trust funds, complete restoration of all the inventoried hazards is unlikely over the next decade

Effects on Mineral Activities from Areas Recommended for Wilderness

Unroaded areas recommended for Wilderness vary by Alternative. Two Alternatives, A and F, propose that the Chama Basin area be recommended for Wilderness Chama Basin has federal surface ownership with privately owned minerals If these areas were proposed, the federal government would first have to acquire the minerals rights Since those lands have high potential for oil and gas resources, it may take substantial efforts to acquire this mineral estate

All other areas recommended for Wilderness are on public domain lands and could proceed toward Wilderness designation without major conflicts

Consistency With the Forest Plan

All mining operations under the 1872 Mining Law are designed to be as compatible with the proposed Forest Plan Goals and Objectives as possible Mineral withdrawals are proposed where mining uses are incompatible with long-term management goals Recommended Wilderness Areas would be legally withdrawn through Congressional action

The use of Operating Plans would mitigate and provide control over surface-disturbing activities for proposed operations Requirements in Operating Plans ensure that all legal requirements of other laws, regulations, and Standards and Guidelines are accomplished After operations, reclamation will restore the surface disturbed by operations

By statute, mining claimants have the right to access and develop a claim The FS cannot deny or unduly delay operations The FS cannot delay or prohibit occupancy beyond the reasonable time frames established by the mining regulations The mining regulations are also very clear in what reclamation needs to be done, and it is the FS's responsibility to see that areas are properly reclaimed.

AFFECTED ENVIRONMENT -- SALABLE MINERALS

Salable minerals include sand, gravel, hard rock for crushing, and landscaping materials to name a few Salable minerals are used internally by the FS or permitted by the FS for private use through sales and permits.

The Forest already has several sites it uses as sources for rock-crushing operations, and no new sites are anticipated for the next ten-year period We estimate that one rock pit might be developed in the next decade Such a development would be fully analyzed and regulated by the FS to assure minimal impacts on ecosystems Such a development would likely disturb a total of ten acres of National Forest lands, which would be reclaimed after use

An analysis of soil potentials for sand and gravel showed 15,000 acres are tentatively suitable This does not mean, however, that all these acres are available The sale and development of common-variety minerals are purely discretionary, and other considerations--such as recreation, wetlands, water quality, wildlife, and scenic quality concerns---may restrict or preclude such activities

ENVIRONMENTAL CONSEQUENCES -- SALABLE MINERALS

Common-variety minerals may be sold or disposed of through free use in any of the proposed Alternatives The Forest issues about ten permits per year, usually for the collection of moss rock for landscaping The Forest itself also uses a small amount of crushed rock for road construction and surfacing No peat sales or topsoil sales have occurred, nor are they anticipated, since such resources have important other values the Forest must protect

Because there are many sources of sand and gravel on private lands in the San Luis Valley, the Forest does not anticipate issuing permits for such materials for commercial operations The Forest supplies small amounts of sand and gravel or rock for Forest, county, and state road projects in or near the Forest Each Ranger District makes available a small amount of building stone (mostly moss rock) to local residents, and this opportunity will continue throughout the planning period

Sand and gravel sources exist in small areas on the Forest Soil survey information identifies several soil units as probable sand and gravel sources There is about 15,935 acres of soils listed as probable sources for sand and gravel

CUMULATIVE EFFECTS -- FROM MINERAL ACTIVITIES AND ON MINERAL ACTIVITIES:

Cumulative effects are shown in Table 3-69 The total estimated disturbance from the minerals program over the next decade would range from about 70 to 219 acres Oil and gas programs have the most impact, but overall these effects are very small, affecting less than .01% of the total Forest lands. These cumulative effects are small compared to other activities such as prescribed fire, timber harvest, livestock grazing, recreation, and natural disturbances

Minerals activities do not preclude other resource uses, such as those involving range, timber, recreation, and wildlife Conflicts can occur, however, between these overlapping uses. Mitigation practices would minimize most effects and limit the conflicts between user groups This Plan has been specifically designed to make minerals consistent with other uses

Minerals programs are affected by the management of other resources on the same lands For example, Alternative E emphasizes recreational uses above other multiple-use management programs The effects on the minerals program would be fewer areas available for leasing, resulting in fewer opportunities for private companies to lease lands and develop energy resources for domestic uses Returns to the federal government from mineral leases and possible production royalties likewise would be reduced

Table 3-69. Summary of Acres Disturbed by Mineral Activities over the next Decade by Alternative

ACTIVITY	ACRES DISTURBED OVER NEXT DECADE						
	ALT A	ALT B	ALT D	ALT E	ALT F	ALT G	ALT NA
Hard Rock Mining	40	40	40	40	40	40	40
Oil and Gas Expl & Devlpmt	14	129	129	129	14	129	129
Oil and Gas Prospecting	5	40	40	40	5	40	40
Salable Minerals	10	10	10	10	10	10	10
TOTAL	69	219	219	219	69	219	219

The RFD forecasts 23 wells on the RGNF This includes the possible development of wells on included private surface/federal minerals lands The BLM *San Luis Resource Area Management Plan* estimates that "the reasonable foreseeable level of development within the planning area (meaning the approximate 500,000 acres of adjacent BLM lands) . would be a maximum of ten APDs and seven geophysical Notices of Intent per year."

This would disturb about 40 acres per year This rate of development has yet to occur, but if it did, the ten-year cumulative effects would be 400 acres for adjacent BLM lands. Private lands could be developed to a small extent

Total disturbance from all minerals developments would be about 469 to 619 acres for the next ten years This is a very small amount considering the five million acres in the Valley and adjacent mountains The scope of cumulative-effects discussion for oil and gas is generally focused on the San Luis Valley and adjacent mountains

RESEARCH NATURAL AREAS

ABSTRACT

Research Natural Areas (RNAs) are selected to preserve a spectrum of relatively pristine areas that represent a wide range of natural variability within important natural ecosystems and environments (e g forest, shrubland, grassland, alpine, aquatic, and geological environments) and areas that have special or unique characteristics of scientific importance

RNAs are also selected to serve as reference areas for evaluating the range of natural variability and the impacts of management in similar environments, protect and maintain representative and key elements of biological diversity at the genetic, species, population, community, and/or landscape levels; serve as areas for the study of ecosystems and ecological processes including succession, provide onsite and extension educational activities, and serve as baseline areas for measuring ecological change

Seven areas totaling 42,778 acres are proposed as RNAs in Alternatives A, B, D, E, and F Six areas totaling 22,678 acres are proposed as RNAs in Alternative G. There are no RNAs proposed in Alternative NA Environments from foothills to alpine in both the Sangre de Cristo and San Juan Mountains are represented The seven areas were selected, in part, where human uses could be accommodated. Appendix D provides additional information on RNAs

INTRODUCTION

There are many protective designations that attempt to maintain natural ecosystem components and processes Besides RNAs, the Forest Service designates botanical, ecological, geological, zoological, and scenic special areas. There are also national recreation areas, wildernesses, and wild and scenic rivers There are similar designations for both private and State lands and in countries all over the world Although the designations differ in their degree of "naturalness," isolation, and management emphasis, they all contribute in important ways to the protection of biological diversity across the landscape

Legal Framework

The Code of Federal Regulations (CFR) 219 25 states that Forest Planning shall provide for the establishment of Research Natural Areas Planning shall make provision for the identification of examples of important forest, shrubland, grassland, alpine, aquatic, and geologic types that have special or unique characteristics of scientific interest and importance and that are needed to complete the national network of RNAs

On July 19, 1993, the Chief of the Forest Service issued a national strategy for recognizing the expanding role of RNAs in ecosystem management On November 1, 1993, the Regional Forester and the Director for the Rocky Mountain Forest and Range Experiment Station called on the Region to expand the RNA system. The Forests were asked to make a

concerted effort to propose some RNAs in their Forest Plan Revisions The RNA system will be most useful for research, monitoring, and biodiversity protection if it is representative of the ecosystem types found on National Forest System lands Some ecosystem types found on the RGNF that would be desirable for representation within the RNA system include

* ponderosa pine
* Douglas-fir
* blue spruce
* white fir
* lodgepole pine
* bristlecone pine
* Engelmann spruce
* subalpine fir
* aspen
* pinyon/juniper
* Gambel oak
* Thurber fescue and Porter ligusticum
* Parry oatgrass, Arizona fescue, muhly, and blue grama
* alpine grasslands, ridges, and fellfields
* montane willows
* subalpine willows
* tufted hairgrass, reedgrass, sedges, and forbs

The RNA identification process used on the RGNF was as follows First, comments from people inside and outside the Forest Service were reviewed to build a list of potential areas Representation was desired in both the Sangre de Cristo Mountains and in the San Juan Mountains, since these two mountain ranges differ in age and geology and reside in separate ecological units (different Ecologic Sections -- see Hierarchy of Ecological Units presented earlier in this Chapter) Second, areas were identified on the Forest where extensive, relatively undisturbed plant communities occurred Finally, areas were screened to find suitable sites in vacant grazing allotments, roadless areas, and unsuitable timber areas The objective was to find good RNA candidates, while minimizing potential conflicts with existing land allocations Areas were selected where current human uses could be accommodated with RNA designation

During the summer of 1994, the Forest contracted with the Colorado Natural Areas Program (CNAP), a program within Colorado State government, to inventory potential RNA candidates The CNAP provided reports of each potential RNA including detailed descriptions, distinguishing features, and acreage by vegetation cover types Some of this information is summarized in Appendix D

AFFECTED ENVIRONMENT

Presently, there are no RNAs on the RGNF We have identified seven areas that we think merit RNA designation to begin building an RNA network of representative ecosystems on the Forest (Table 3-70) Appendix D contains descriptions of the proposed RNAs

Table 3-70 Proposed RNAs on the RGNF

AREA	ACRES	VEGETATION ZONE [1/]	MOUNTAIN RANGE
Mill Creek	2,555	Foothills, Montane & Subalpine Zones	Sangre de Cristos
North Zapata	6,114	Montane, Subalpine and Alpine Zones	Sangre de Cristos
Deadman Creek	4,777	Montane, Subalpine, and Alpine Zones	Sangre de Cristos
Spring Branch	4,053	Foothills and Montane Zones	San Juans
Hot Creek	1,773	Montane Zone	San Juans
Finger Mesa	3,406	Alpine and Subalpine Zones	San Juans
Little Squaw Creek	20,100	Alpine and Subalpine Zones	San Juans
TOTAL	42,778		

[1/] Zones are generalizations for the Forest as follows
Foothills Zone -- <= 8,000 feet elevation
Montane Zone -- 8,000 feet to 10,000 feet
Subalpine Zone -- 10,000 feet to 11,800 feet
Alpine Zone -- >= 11,800 feet

In December, 1994, the Forest mailed a newsletter informing people of the RNAs that would be proposed in the Draft Environmental Impact Statement (DEIS) The response to the newsletter was mixed

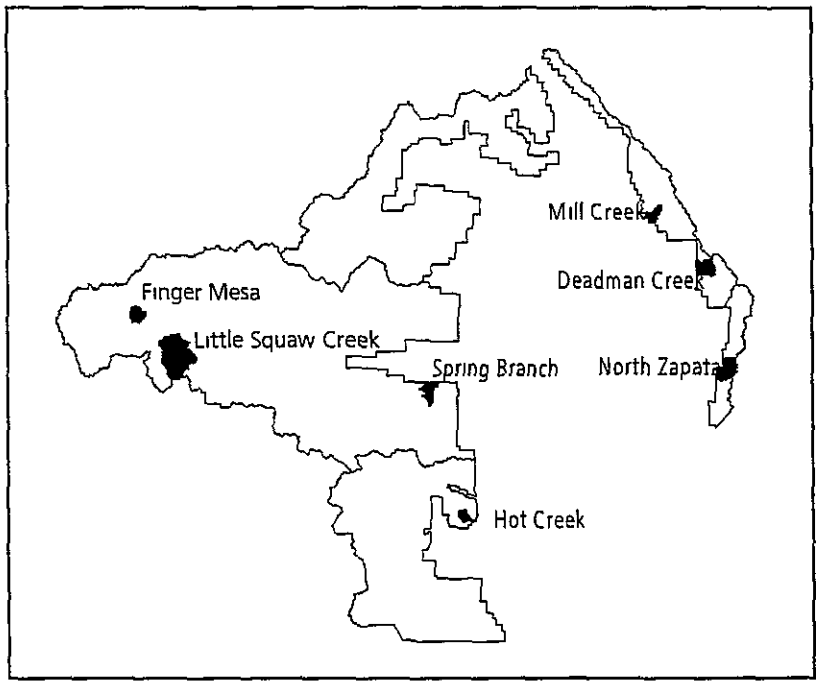


Figure 3-90. Locations of Proposed RNAs

Support was expressed for the idea of protecting habitat to maximize biological diversity and preserving ecosystems Some people felt that the Forest Service needed to allocate more land to RNAs Some wanted to see a more extensive RNA network on the Forest to connect wildlife habitat and limit development of resources Some wanted "sustainable-use areas" with a large portion of the remaining Forest allocated to minimal human interference. Some wanted more redundancy of habitat captured in an RNA system on the Forest The Forest was asked to designate more areas in the transition between the San Luis Valley and the foothills of the San Juan Mountains

There was a comment that RNAs should not be used to justify additional timber sales in other, less used, portions of the Forest

On the other hand, there was sentiment that there should be fewer or no RNAs allocated on the Forest There was concern that the Forest was proposing too many areas and that the areas were too large There was concern over the future use and availability of RNAs for use by permitted outfitters and guides There was concern expressed that there are already enough restrictive land allocations on the Forest. There was a concern that commodity resources would not be used for human benefit Some people wanted RNAs designated only in Wilderness areas Access was a concern to some folks (especially motorized access). People did not want RNAs used as a hidden method to limit access There was reaction to the statement "limited human intervention" in the newsletter that was bothersome to many people This seemed to lead to misunderstandings of whether horseback riding, hunting, fishing, or camping would be allowed Some felt RNAs just create more complex government and they want simpler government

Finally, the public reaction to the published DEIS was very similar to the comments received in reaction to the newsletter described above

ENVIRONMENTAL CONSEQUENCES

Direct and Indirect Effects

Research Natural Areas are managed to maintain natural (relatively pristine/presettlement) conditions by allowing ecological processes to prevail with minimal human intervention However, under some circumstances, deliberate manipulation may be used to maintain the ecosystem or unique features for which the RNA was established or to reestablish natural ecological processes Vegetation, habitat, soil productivity, water quality, and ecological processes will be in a natural condition or in as close a natural condition as practicable Heritage resources are protected by default from RNA designation since ground-disturbing activities are limited Specific management direction (addressing issues such as fire management) may be developed for each RNA in separate Management Plans These Management Plans would provide greater detail for implementing the direction provided by the Management-area Prescription (2 2)

The boundaries of each proposed RNA were aligned with watershed boundaries whenever possible. Sometimes, a grazing allotment boundary was used so that the proposed RNA did not infringe on an active livestock allotment. The size of each proposed RNA was designed to maintain ecosystem processes and landscape-scale natural disturbance patterns, where feasible The local impacts of recreation are much less significant in large areas because they have a smaller overall effect on ecosystem composition, structure, and processes

There are no RNAs proposed for Alternative NA Seven RNAs are proposed for Alternatives A, B, D, E, and F (42,778 acres total) Six RNAs (with dropping Little Squaw Creek) are proposed for Alternative G (22,678 acres total). A variety of uses are allowed in RNAs as long as the activity or use does not become a threat to the values for which the RNA was proposed The effects of significant activities and resources on RNAs and the effects of RNAs on significant activities and resources are listed below

Effects on RNAs from Timber Management

The proposed RNAs are not available for timber harvest, so the small parts of these proposed RNAs that are suitable for timber harvest are removed from the suitable timber base Table 3-71 shows the amount of tentatively suitable timber lands within each proposed RNA

Table 3-71 Tentatively suitable timber land acres within each proposed RNA

AREA	Tentatively Suitable Timber Land Acres
Mill Creek	0
North Zapata	0
Deadman Creek	0
Spring Branch	130
Hot Creek	256
Finger Mesa	777
Little Squaw Creek	24
TOTAL	1,163

There are about 1,163 acres of lands classified as tentatively suitable for timber harvest within proposed RNA boundaries that would not be available for timber harvest There are 745,252 acres of tentatively suitable forest lands on the RGNF This represents less than a 0 2% reduction from the total tentatively suitable land base (1,163 acres divided by 745,252 acres)

Effects on RNAs from Range Management

The grazing allotments within each RNA boundary will be administratively closed to livestock grazing, except in the proposed Hot Creek RNA All the other RNAs are in vacant grazing allotments (there are no current grazing permits for the affected allotments). The Hot Creek proposed RNA is a subset of the larger Hot Creek grazing allotment, which is under a valid grazing permit However, the Hot Creek proposed RNA is not generally grazed by livestock, largely because the area is inaccessible The current Hot Creek allotment permittees have agreed to continue to avoid grazing the area inside the proposed RNA There is no change in permitted livestock on the Forest from designating RNAs.

There are 35 vacant allotments on the RGNF. Table 3-72 shows the allotments affected by each proposed RNA All allotments are vacant with the exception of Hot Creek

Table 3-72. Livestock allotments affected by each proposed RNA

AREA	Affected Allotments
Mill Creek	Dimick, Rito Alto
North Zapata	None
Deadman Creek	Music, Sand Creek
Spring Branch	Sloan
Hot Creek	Hot Creek
Finger Mesa	Finger Mesa
Little Squaw Creek	Officer, Cimmarron; Texas, Trout Middle Trout

Exotic (non-native) plant species will be controlled where feasible and socially desirable The control method selected will minimize threats to native species. Currently, there are no significant infestations of exotic species needing treatment in any of the proposed RNAs

Two RNAs, Hot Creek and Spring Branch, would benefit from fencing to reduce the potential for livestock from wandering into the areas Hot Creek would need about one mile of fence reconstruction along the northern boundary to better separate it from the adjacent allotment Spring Branch would need two miles of fence reconstruction on the northern end, next to the BLM lands The southern portion and western boundary need about five miles of fence reconstruction to keep adjacent livestock from wandering into the RNA.

Approximately eight miles of fence would be needed for the two RNAs Costs for fencing are about $4,000 to $5,000 per mile, depending on terrain Thus, estimated fencing costs would be about $36,000

Effects on RNAs from Recreation Management

The Forest Service will not actively advertise RNAs as destinations for recreation use However, existing nonvehicular recreation use will be allowed as long as the use does not become a threat to the values for which the RNA was proposed Current levels of horseback riding, hunting, fishing, camping and related low-impact uses by the public will be allowed to continue. If resource degradation develops from increased future use, then the public will be encouraged to shift use to other, less impacted areas The same kinds of monitoring and assessments of recreation use in Wilderness would apply to RNAs

Trails that exist before a RNA is designated are allowed for recreation, scientific, or educational access, unless they threaten the values for which the RNA was proposed The construction of new trails is prohibited unless necessary to correct resource damage occurring from existing trails No change in the trail system is anticipated for any of the proposed RNAs

Mountain bikes are not allowed within RNAs, unless they provide necessary access for scientific or educational purposes There is no mountain bike use in the proposed RNAs that occur within Wilderness because of Wilderness regulations The other proposed RNAs do

not have trails that are suitable or used for mountain biking Mountain bikes will continue to be allowed on Forest Development Road 327 (Cedar Springs road), which forms a non-RNA corridor through Spring Branch proposed RNA

Existing outfitter and guide permitted use will be allowed to continue within RNAs, subject to the normal permit review processes that apply to all National Forest System lands Permits for new use may not be issued in the future

The use of All-Terrain Vehicles (ATVs) is not allowed in RNAs An exception is made for Spring Branch proposed RNA for Alternative B, where ATV use for game retrieval is allowed The ATV game-retrieval policy has specific rules and conditions explained in the Travel Management section of this chapter Snowmobiles are not allowed in RNAs Other forms of motorized use are not allowed unless absolutely necessary for research or educational access

Most of the proposed RNAs are in Wilderness or an allocation where Wilderness is recommended Table 3-73 shows the acres of RNAs within Wilderness and the acres outside Wilderness Little Squaw Creek proposed RNA is almost entirely in Wilderness and it makes up over 20,000 acres of the RNAs within Wilderness

Table 3-73. RNA acres within Wilderness, proposed Wilderness, and acres outside Wilderness

	ALTERNATIVE						
	A	B	D	E	F	G	NA
RNA acres within designated Wilderness	31,882	31,882	31,882	31,882	31,882	11,824	0
RNA acres within proposed Wilderness	3,200	0	0	0	3,383	0	0
RNA acres outside Wilderness	7,696	10,896	10,896	10,896	7,513	10,854	0
TOTAL	42,778	42,778	42,778	42,778	42,778	22,678	0

The percentage of each RNA in designated and proposed Wilderness for the different Alternatives is shown in Table 3-74 Alternative F allocates the most RNA acreage to designated or proposed Wilderness, Alternatives B, D, E, and G the least Alternative NA proposes no RNAs

Table 3-74 Percent of Each Proposed RNA in Designated or Proposed Wilderness

PROPOSED RNA	Percent of RNA in Designated or Proposed Wilderness by Alternative						
	A	B	D	E	F	G	NA
Mill Creek	100	38	38	38	38	38	*
North Zapata	100	100	100	100	100	100	*
Deadman Creek	100	100	100	100	100	100	*
Spring Branch	0	0	0	0	0	0	*
Hot Creek	0	0	0	0	0	0	*
Finger Mesa	100	0	0	0	100	0	*
Little Squaw Creek	100	100	100	100	100	*	*
* No Proposed RNAs in this Alternative							

Effects on RNAs from Minerals Exploration and Extraction

Research Natural Areas are specifically discussed in the Minerals section of this chapter The following information provides a summary for locatable, leasable, and salable minerals.

There are no existing mining claims within the proposed RNAs except in the proposed Finger Mesa RNA These claims do not threaten the values for which the RNA was proposed. All RNAs will be proposed for withdrawal from locatable mineral entry Withdrawals must be applied for through the Secretary of Interior Designated Wilderness areas are withdrawn from locatable mineral entry as part of Wilderness legislation (see Table 3-66 for RNA acres within designated Wilderness)

Oil and Gas leasing availability varies by Alternative. Alternatives A and F have Discretionary No Lease as their proposed leasing option, which means the lands within RNAs are not available for leasing Alternative B has two leasing options, Standard Lease Terms (B1) and No Surface Occupancy (B2), only one of which might be selected by the decision maker. Standard Lease Terms means RNAs would be available for leasing No Surface Occupancy means RNAs would be available for leasing, but there could be no site occupancy Alternatives D, E, and G also have No Surface Occupancy as their leasing option Alternative NA proposes no RNAs, therefore, no leasing discussion is needed

Discretionary No Lease and No Surface Occupancy would best protect the values for which the RNAs were proposed Standard Lease Terms would provide the least protection of RNA values. Oil and gas development would be incompatible with RNA objectives since site occupancy and ground disturbance occurs

Salable minerals (sand, gravel, hard rock for crushing, and landscape materials) would not be allowed in RNAs There is no anticipated need for more salable mineral sources over the next ten-year period from the Forest Thus, the proposed RNAs do not affect the salable minerals program

Effects on RNAs from Roads

New road construction in RNAs is prohibited Existing roads are closed or obliterated except where needed for necessary scientific, educational, or administrative purposes

There are no Forest Development Roads proposed for closure in any of the proposed RNAs However, volunteer two-track roads within proposed RNAs will be closed This applies primarily to the Spring Branch proposed RNA, where there are several volunteer roads Forest Development Road 327 (Cedar Springs Road), and 300 feet on either side of this road, have been excluded from within the boundaries of the Spring Branch proposed RNA Also see Effects - Recreation Management for ATV policy in RNAs.

The addition of up to seven RNAs does not affect the amount of Forest Development Roads on the Forest

Effects on Fire Management

Prescribed natural fires will be allowed to burn, except where there is substantial threat to human life or property outside the RNA boundary or where fire threatens values for which the RNA was designated Human-caused fires will be controlled, where possible All fires will be controlled where excessive fuel buildup from past fire suppression threatens the RNA

The use of management ignited prescribed fire may be allowed to restore a natural fire regime or to reduce unnatural fuel loads Fire suppression techniques will minimize ground disturbance Natural barriers will be used to confine or contain fire where possible

There are no known immediate needs for prescribed fires in the seven proposed RNAs

Effects on RNAs from Fish and Wildlife Management

Habitat manipulation for wildlife is prohibited unless it is specifically needed to restore natural ecosystem conditions Habitat manipulation is allowed if specifically designed for the protection of threatened, endangered, or sensitive species There are no habitat manipulation projects needed in the proposed RNAs at this time

Exotic (non-native) animal species will be controlled where feasible and socially desirable The control method selected will minimize threats to native species. Presently, there are no known exotic species needing control in any of the proposed RNAs

Effects on RNAs from Threatened, Endangered, and Sensitive Species

There are no known populations of federally listed Threatened or Endangered Species or USDA Forest Service, Rocky Mountain Region Sensitive Species on any of the proposed RNAs However, any populations of these species that might be located in the future would be given additional protection through RNA designation RNAs would be managed to insure protection for these species

Effects on RNAs from Cultural Resources

There are no known archeological or other cultural resources on any of the proposed RNAs However, any of these resources that might be located in the future would be given additional protection through RNA designation

Effects on RNAs from Utility Corridors

There are no proposed utility corridors within any of the proposed RNAs There are no known effects from proposed RNAs on utility corridors

Effects on RNAs from Insect and Disease Management

Natural outbreaks of native insects and disease are allowed to proceed without intervention, unless they are a substantial threat to important resources inside or outside the RNA boundary Control methods will minimize disturbance There are no insect or disease problems that pose a problem on any of the RNAs at this time

Effects on RNAs from State Water Quality and Air Quality Standards

The proposed RNAs will have no significant effect on air or water quality within or outside the RGNF

Effects on RNAs from Special Uses

Proposals for non-manipulative research will require approval of the Rocky Mountain Forest and Range Experiment Station Director and the applicable District Ranger

Special Use permits can be issued when they do not conflict with the values for which the RNA was proposed The need for Special Use permits will be evaluated on a case-by-case basis

Effects on RNAs from Facilities Management

Buildings and developed recreation sites are prohibited, unless there are exceptional circumstances (such as historic sites, districts, buildings, structures, places, or objects eligible or listed in the National Register of Historic Places) which do not threaten the values for

which the RNA was proposed There are no known eligible or listed heritage resources or other buildings or structures within any of the proposed RNAs Some unnecessary internal fencing within the Spring Branch RNA might be removed to allow more natural movements of native ungulates

CUMULATIVE EFFECTS

Research Natural Areas add minor acreage, relative to the Forest as a whole, to Management Emphasis Categories one and two These Categories contain relatively restrictive Management-Area Prescriptions. Designating RNAs on the RGNF will add to a national network of RNAs There are 318 established RNAs nationwide with an additional 300 or more proposed for establishment There are ten established RNAs in Colorado

WILDERNESS

ABSTRACT

The RGNF has portions of four designated Wilderness areas totaling 430,300 acres or about 22% of the Forest's total acreage Wilderness Implementation Schedules (action plans) for each Wilderness area have been written and approved and will assist in establishing annual management priorities (budget and monitoring) None of the Alternatives affect the management of the Forest's Wilderness areas

INTRODUCTION

Legal Framework

The *Wilderness Act of 1964* established a National Wilderness Preservation System (NWPS) consisting of federally owned areas designated by Congress as "Wilderness " These areas are managed to retain their natural influences without improvements or human habitation, and to preserve their natural character Section 219 18 of 36 CFR 219 states "Forest planning shall provide direction for the management of designated Wilderness "

Wilderness Need

Background

The La Garita Wilderness was designated with the enactment of the 1964 Wilderness Act The 1975 Wilderness Act established the largest Wilderness in Colorado, the Weminuche Wilderness

In 1979, the second Roadless Area Review and Evaluation dealt with the need for Wilderness on a national basis Based on this analysis, the 1980 Wilderness Act designated certain National Forest System lands in Colorado as components of the NWPS On the RGNF, this included additions to the Wemuniche Wilderness and the establishment of the South San Juan Wilderness.

The 1993 Colorado Wilderness Act designated additional National Forest System lands as Wilderness This included additions to the La Garita, Weminuche and South San Juan Wilderness areas and the designation of the Sangre de Cristo Wilderness area.

Unroaded Areas

The RGNF performed a new Roadless Area inventory to identify areas for potential Wilderness designation All unroaded areas on the Forest were identified using the following criteria Areas containing 5,000 acres or more, or containing less that 5,000 acres that (1) because of physiographic or vegetation are manageable in their natural condition, (2) are self-contained ecosystems, (3) are next to existing Wilderness, WSAs, or roadless areas in other Federal ownership, whatever the size.

Fifty-three unroaded and undeveloped areas adjacent to Wilderness, totaling 530,722 acres, were identified on the Forest These areas were evaluated based on their capability, manageability, and suitability (Refer to Appendix B for further details regarding the evaluation process. In the Unroaded section in this chapter, Table 3-79 outlines by Alternative the Management Prescriptions allocated to these areas

Proximity of Designated Wilderness/Recommended WSA to the RGNF.

Prior to 1980, there were seven Wilderness Areas within a 100-mile (air miles) radius of the RGNF. Two of the seven were the La Garita and Wemuniche Wilderness areas With the enactment of the 1980 and the 1993 Colorado Wilderness Acts, 15 additional Wilderness Areas (22 total) are within a 100-mile radius of the Forest

In October 1991, the Bureau of Land Management recommended 20 of 51 area for inclusion to the NWPS Five of these recommended Wilderness Study Areas are within a 100-mile radius of the Forest

These 27 areas total 2,290,810 acres and contain a variety of landtype associations, wildlife species, and habitats in addition to recreation opportunities. The following table lists the Wilderness Areas and WSAs close to the RGNF

Table 3-75. Wilderness and Wilderness Study Areas in Proximity to the RGNF

Wilderness and Wilderness Study Areas in Proximity to the RGNF.		
Area	**Agency**	**Acreage**
American Flats (WSA)	Bureau of Land Management	1,494
Beaver Creek (WSA)	Bureau of Land Management	20,750
Black Canyon of Gunnison (NM)	Park Service	20,766
Brown Canyon (WSA)	Bureau of Land Management	6,614
Buffalo Peaks	Forest Service	43,410
Collegiate Peaks	Forest Service	159,000
Cruces Basin (New Mexico)	Forest Service	17,600
Dolores River Canyon (WSA)	Bureau of Land Management	29,415
Fossil Ridge	Forest Service	33,060
Great Sand Dunes (NM)	Park Service	33,450
Greenhorn Mountain	Forest Service	22,040
Gunnison Gorge (WSA)	Bureau of Land Management	22,078
Hunter-Fryingpan	Forest Service	82,780
La Garita	Forest Service	130,001
Lizard Head	Forest Service	21,400
Maroon Bells-Snowmass	Forest Service	174,329
Mesa Verde National Park	Park Service	54,700
Mount Massive	Forest Service	26,000
Mount Sneffles	Forest Service	16,200
Piedra Area	Forest Service	62,550
Powderhorn	BLM and Forest Service	60,100
Raggeds	Forest Service	73,500
Sangre de Cristo	Forest Service	218,922
South San Juan	Forest Service	164,563
Uncompahgre	Forest Service and BLM	101,905
Weminuche	Forest Service	499,771
West Elk	Forest Service	194,412
Total		**2,290,810**

Factors

The following factors were used in considering the need for Wilderness on the Forest

* About 22% of the Forest's land base is designated Wilderness'

* Wilderness Areas and WSAs, and the opportunities they provide, are not in short supply on the Forest, or near it.

* In the Forest Plan analysis, three of seven Alternatives recommended all or some unroaded and undeveloped areas adjacent to Wilderness for inclusion in the NWPS

* The Forest's unroaded areas offer opportunities for primitive and semi-primitive recreation (both nonmotorized and motorized) outside Wilderness.

* Management of the Forest's unroaded areas for backcountry recreation opportunities will meet the demand for a variety of recreation uses outside Wilderness.

Summary

Additional Wilderness Areas are not needed on the RGNF. This determination is based on

* There are 27 Wildernesses or WSAs, totaling 2,290,810 acres, within a 100-mile radius of the Forest The Forest has 22% of its land base in Wilderness. These areas have a wide variety of LTAs, wildlife species, and habitats, as well as opportunities to experience Wilderness

* Wilderness and WSAs, and the opportunities they provide, are not in short supply on the Forest, or near it

* There is a demand for primitive and semi-primitive recreation opportunities (both motorized and nonmotorized) outside Wilderness.

* The Forest has numerous unroaded areas outside Wilderness that can provide primitive and semi-primitive recreation opportunities

* Given the availability of Wilderness on the Forest and nearby, these areas provide the necessary capabilities and opportunities to meet the projected increase in recreation use and demand for Wilderness during the next planning period

Wilderness Availability and Management

Portions of the La Garita, Weminuche, South San Juan, and Sangre de Cristo Wildernesses are on the RGNF (see Figure 3-91) Collectively, these Wildernesses comprise 430,300 acres Table 3-76 shows how the Rio Grande compares with the Rocky Mountain Region, and nationally, in providing Wilderness

Table 3-76. Wilderness Comparison

	Rio Grande NF	Region 2	National
Wilderness Acres	439,600	3,147,686*	34,628,754 [1]
Acres National Forest Lands	1,935,354	22,073,573*	191,553,355 [2]
Percent Wilderness	22 7%	14 3%	18 1%

[1] These are National Forest Wilderness acres only
[2] Figures taken from *Land Areas of the National Forest System*, September 1993 United States Department of Agriculture - Forest Service FS-383

The National Forests in Colorado have begun managing Wilderness Areas under the "single-unit management" concept Designated lead Ranger Districts and a Wilderness Coordination Team have been established for coordinating, developing, and carrying out Wilderness management strategies and action plans (Wilderness Implementation Schedules) The following chart identifies the Forest and/or Ranger District responsible for the coordination and management of the four designated Wilderness Areas·

Wilderness	Single-Unit Management
La Garita	Cebolla RD, Gunnison NF
Sangre de Cristo	San Carlos RD, Pike and San Isabel NF
Weminuche, South San Juan, Piedra Area	Wilderness Coordination Team, San Juan - Rio Grande NFs

Wilderness Implementation Schedules (Action Plans) and single-unit management are the same in all Alternatives

The RGNF can meet projected recreational demands and non-recreational uses for Wilderness throughout the planning period with our current Wilderness acres. This will be accomplished by having a variety

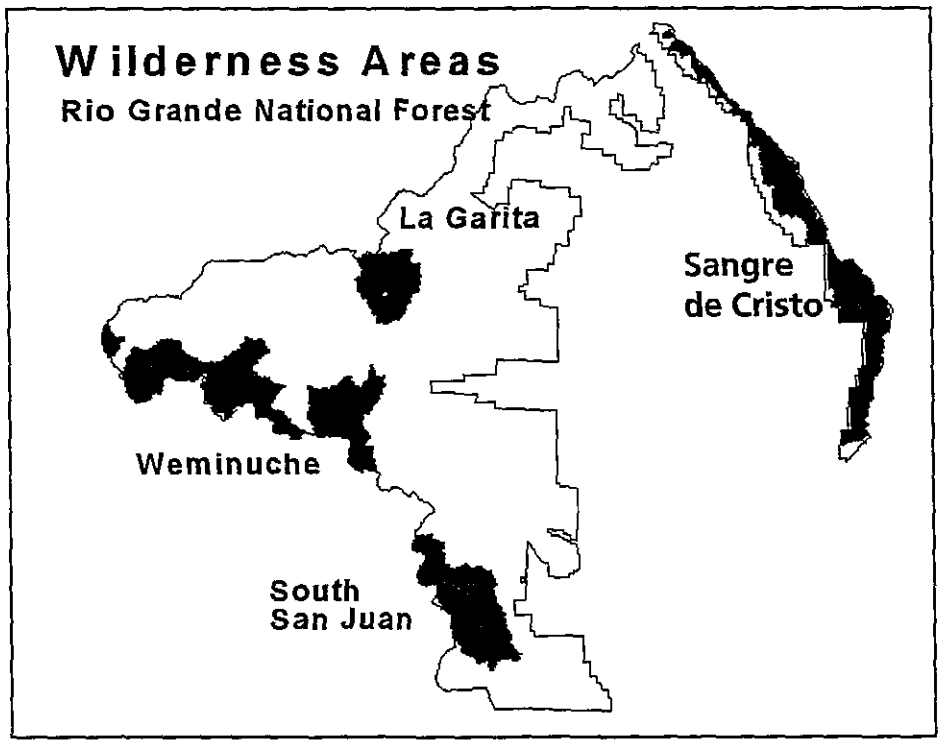


Figure 3-91. Map of Wilderness areas on the RGNF

of Wilderness settings, implementing Wilderness action plans, increasing monitoring of Wilderness resources, and implementing capacity allocations.

Sensitive animal species are likely and suspected to occur in all Wildernesses. (Reference Table 3-25 in the TES Animal/Viability section for more details and a listing of the Sensitive animal species) All species listed, except those found in the western wheatgrass LTA, may reside in each Wilderness Area The Wilderness Areas provide potential foraging habitat for Peregrine Falcons (T&E) and potential habitat for the Uncompahgre Fritillary Butterfly (T&E)

Sensitive plant species likely to occur in each of the Forest's Wilderness Areas are those plants associated with subalpine and alpine vegetation zones Reference the TES Plant Section in this chapter for more details.

The following section summarizes each of the Forest's Wilderness Areas

LA GARITA WILDERNESS

The La Garita Wilderness is on the Cebolla RD, Gunnison NF, and portions of the Divide and Saguache RDs, RGNF This 49,000-acre Wilderness was one of the original five designated in Colorado when the Wilderness Act was passed in 1964 It has been enlarged twice and now contains 130,001 acres, of which 55,228 are on the RGNF

Elevation ranges from 9,000 feet to over 14,000 feet in the following LTAs Aspen on Mountain Slopes, Englemann Spruce on Mountain Slopes, and Alpine Sedges and Forbs on Alpine Summits.

Current Management Prescriptions: About 90% is managed for a Semi-Primitive Wilderness setting and 10% for Primitive Wilderness

Management Issues: Concentrated use in and around Machin Lake, public concern about livestock grazing in the Wilderness

Grazing Allotments: There are two active grazing allotments (Rio Grande portion) Approximately 2,880 animal unit months (AUMs) of grazing are permitted on about 5,000 acres Recreation stock accounts for about 80 AUMs

Recreation Visitor Days (RVDs): 12,700 (RGNF, FY94)

Special Uses: There are 12 RGNF outfitter-guide permit holders (summer and fall) who operate within this Wilderness, and one non-recreation special use permit

There are 175 miles of trail within the La Garita Wilderness, including sections of the Colorado Trail and the Continental Divide National Scenic Trail Recreation use is concentrated along access trails and near popular high-elevation lakes, since cross-country travel is difficult

Wheeler Geologic Area

The Forest and the La Garita Wilderness Operation Team recognize the Wheeler Geologic area as a unique feature within the Wilderness that will require special management to maintain its character The four-wheel-drive road remains available for motorized access to within ½ mile of the Wheeler Geologic Area Because of recent publications about this area's unique formations, it has become a popular destination with visitors This tends to draw a higher number of people attempting to see the geologic formation without seeking a Wilderness experience This one location will attract a variety of recreation users and higher use than can be expected within the remaining areas of the La Garita Wilderness

The La Garita Wilderness Operation Team recognizes that the Wheeler Geologic Area may not conform to the traditional Wilderness philosophy, due to its appeal to non-Wilderness visitors Therefore, Desired Conditions will have to be tailored to this area to ensure it is protected for its recognized values, while also protecting the surrounding Wilderness Area and values

The La Garita Wilderness Operation Team has established the following Goals for the Wheeler Geologic Area

* Recognize that the Wheeler Geologic Area is unique from the other areas in the La Garita Wilderness

* Recognize that visitation will be higher at the Wheeler Geologic formations without jeopardizing the integrity of the remaining Wilderness Area

* Protect the resources located in the Wheeler Geologic Area

* Provide interpretation outside the Wilderness Area to educate and inform visitors about the fragile nature of the Wheeler Geologic Area, values and character of Wilderness, and need to practice low-impact techniques

* Continue to manage the Geologic Area as a "Day-Use Area Only "

* Work with publishing entities to decrease their publications about the Wheeler Geologic Area

The following management actions will be necessary to carry out the about goals

* Issue Special Orders to prohibit the following activities camping, building campfires, and/or tethering, hobbling, picketing, or tying livestock within the recognized boundaries of the Wheeler Geologic Area

* Stabilize and/or complete structural fortification of the past historic Park Service administrative cabin

* Develop appropriate informational and educational materials about the Wheeler Geologic Area by 1998 This information will inform the public about Wilderness values, low-impact techniques, the fragility of the geologic formation, heritage resources, and the need to preserve and protect all these resources

* Develop a monitoring plan to evaluate recreational impacts specific to the Wheeler Geologic Area

* Determine the eligibility of the Park Service cabin for the Federal Register of Historic Places

* Determine the frequency and extent that visitors to the Wheeler Geologic Area use other portions of the La Garita Wilderness

WEMINUCHE WILDERNESS

The Weminuche Wilderness is on the Columbine, Pagosa and Divide Ranger Districts, San Juan - Rio Grande National Forests This Wilderness was first designated in 1975, with subsequent additions in the 1980 and 1993 Colorado Wilderness Acts

The Weminuche is the largest Wilderness in Colorado, comprising 499,771 acres, of which 164,995 are on the Divide RD Elevation ranges from 8,000 feet to over 14,000 feet, in the following four LTAs on the SJNF, Ponderosa Pine on Mountain Slopes and White fir and Douglas-fir on Mountain Slopes, throughout the high elevations on both Forests, Engelmann spruce on Mountain Slopes and Alpine Sedges and Forbs on Alpine Summits

Current Management Prescriptions: Approximately 80% is managed for the Semi-Primitive Wilderness setting, 12% managed for Primitive Wilderness, and 8% managed for Pristine Wilderness.

Management Issues: Large groups and the need for a capacity determination

Grazing Allotments: There are 14 allotments (RGNF portion), of which five are active (two in nonuse and three used) Approximately 840 AUMs of grazing are permitted on about 10,236 acres Recreation stock accounts for 130 AUMs of grazing.

Recreation Visitor Days: In FY 94, RVDs amounted to 63,500

Special Uses: There are 14 RGNF outfitter-guide permit holders (summer and fall) who operate within this Wilderness, several nonrecreational permits (pipelines, gaging stations, and ditches) also are authorized

This Wilderness contains 81 high-elevation lakes and the headwaters of the Rio Grande, San Juan, Animas, Los Pinos, and Piedra Rivers There are 31 trailheads providing access to 490 miles of trail Portions of the Colorado Trail and the Continental Divide Scenic Trail are in this Wilderness Habitat for sensitive species of birds, fish, and mammals is present Recreation use is concentrated within well-known high-elevation basins or drainages near lakes

SOUTH SAN JUAN WILDERNESS

The South San Juan Wilderness is situated on the Pagosa and Conejos Peak Ranger Districts, San Juan - Rio Grande NFs This Wilderness was designated in 1980 by the Colorado

Wilderness Act and enlarged by the 1993 Colorado Wilderness Act It contains 164,583 acres of which 88,923 are on the Conejos Peak RD

This Wilderness straddles the Continental Divide from just south of Summit Peak on Elwood Creek, south along the Divide to Trail Lake Elevation ranges from 7,500 feet to over 13,000 feet It includes the following LTAs On the SJNF, Ponderosa Pine on Mountain Slopes and White Fire and Douglas-fir on Mountain Slopes, and throughout the higher elevations of both Forests, Engelmann spruce on Mountain Slopes and Alpine Sedges and Forbs on Alpine Summits

Current Management Prescriptions: Roughly 80% is managed for the Semi-Primitive Wilderness setting, 9% is managed for Primitive Wilderness, and 6% is managed for Pristine Wilderness

Management Issues: Resource impacts caused by stock (mainly horses)

Grazing Allotments: There are 13 RGNF allotments that permit 7,540 AUMs of grazing on about 62,481 acres Recreation stock accounts for about 60 AUMs of grazing

Recreation Visitor Days: RVDs in FY 94 totaled 40,800

Special Uses: There are 11 RGNF outfitter-guide permit holders who operate in the summer and fall within this Wilderness, and several non-recreation permits (pipeline or ditches) authorized

There are 164 miles of trail within this Wilderness, including portions of the Continental Divide National Scenic Trail It contains habitat for Sensitive species of birds, fish, and mammals Recreation use is concentrated along access trails or popular high-elevation lakes

SANGRE DE CRISTO WILDERNESS

The Sangre de Cristo Wilderness is on the Salida and San Carlos Ranger Districts, Pike and San Isabel NF, the Conejos Peak and Saguache Districts, RGNF, and the Canon City District, Bureau of Land Management The 1993 Colorado Wilderness Act transferred the BLM's Wilderness acres to the Forest Service The RGNF portion covers some 125,660 acres

The Sangre de Cristo range divides the San Luis Valley and the Rio Grande drainage from the Wet Mountain Valley and the Arkansas drainage This long, narrow range extends from the area just south of Fremont Mountain some 70 miles to Ellingwood Point The Great Sand Dunes National Monument is next to the southern section of the Wilderness

Elevation ranges from 8,200 feet to over 14,000 feet, and includes the following Landtype Associations Pinyon on Mountain Slopes (lands transferred from the BLM), Ponderosa Pine on Mountain Slopes, White Fir and Douglas-Fir on Mountain Slopes, Engelmann Spruce on Mountain Slopes, and Alpine Sedges and Forbs on Alpine Summits

Current Management Prescriptions: About 80% is managed for the Semi-Primitive Wilderness setting, 15% for Primitive Wilderness, and 5% for Pristine Wilderness